10 NOVEMBER 1961

METAL INDUSTRY

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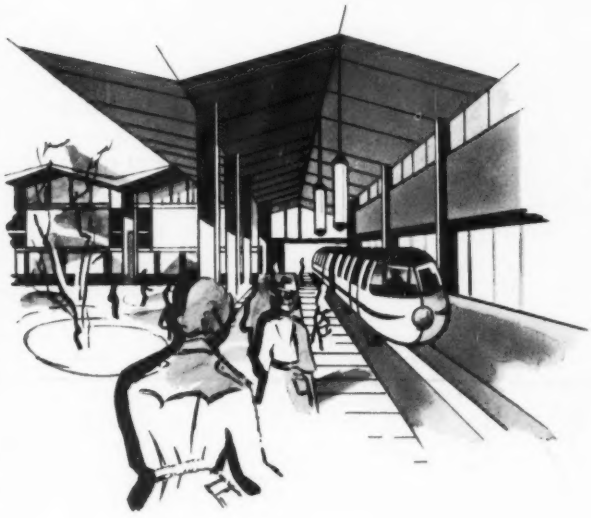

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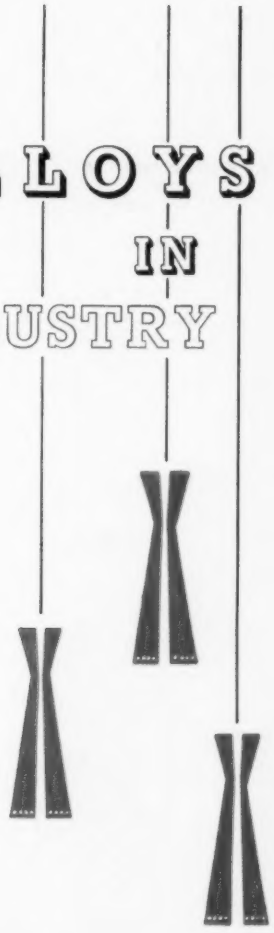

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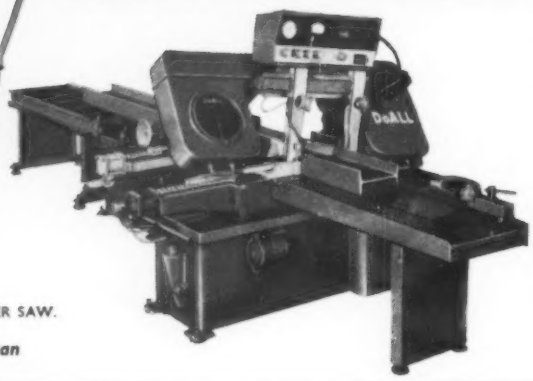

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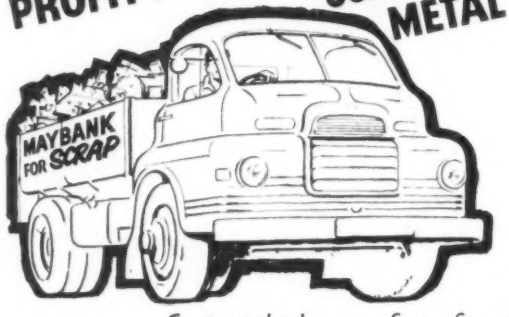

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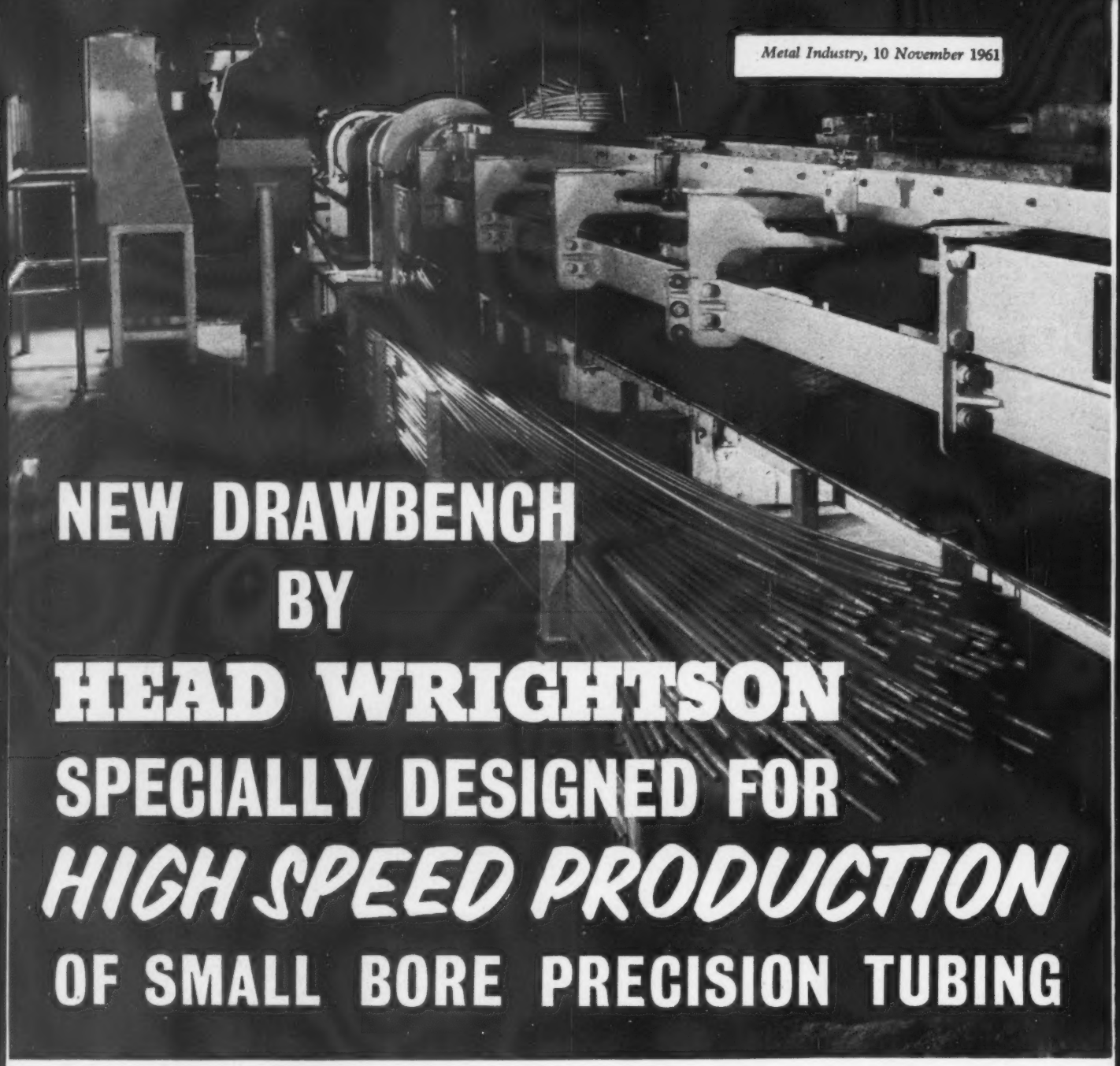

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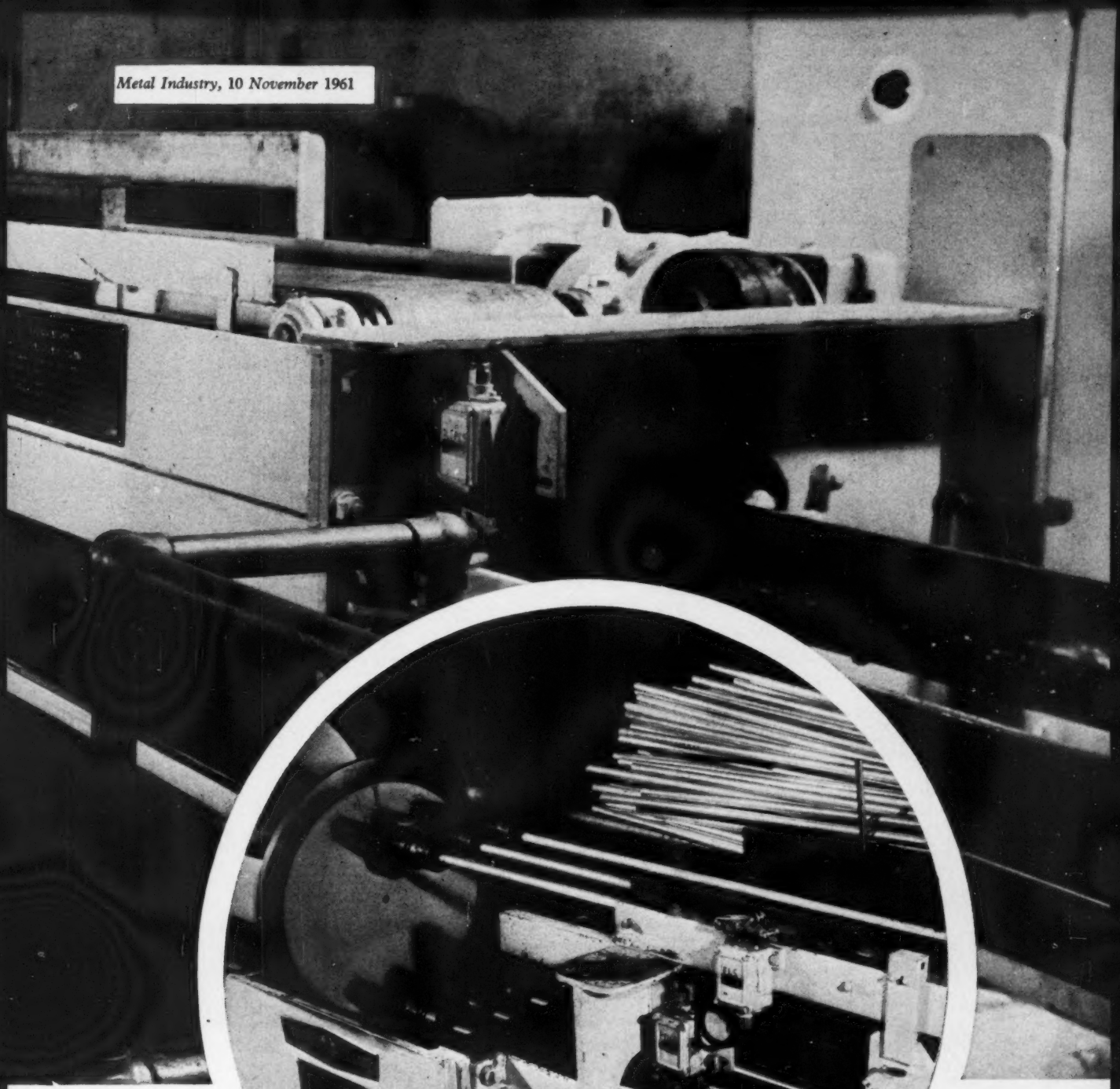

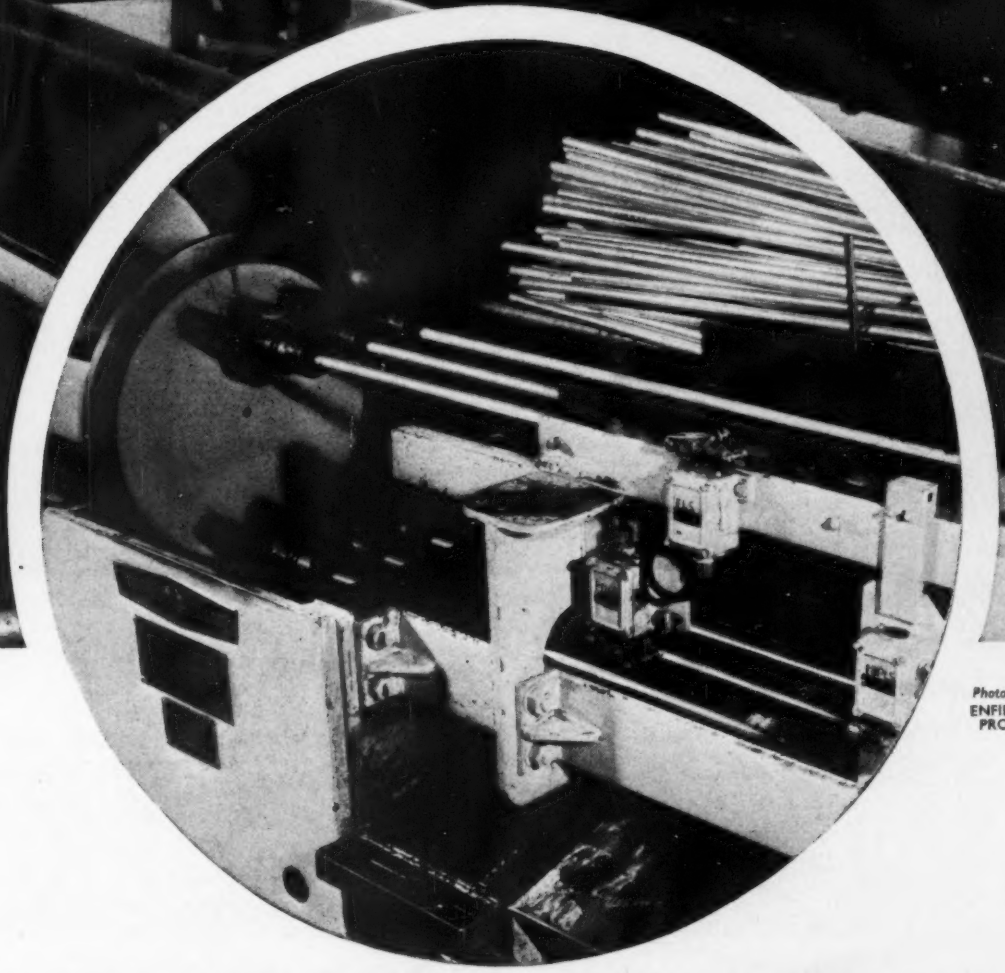

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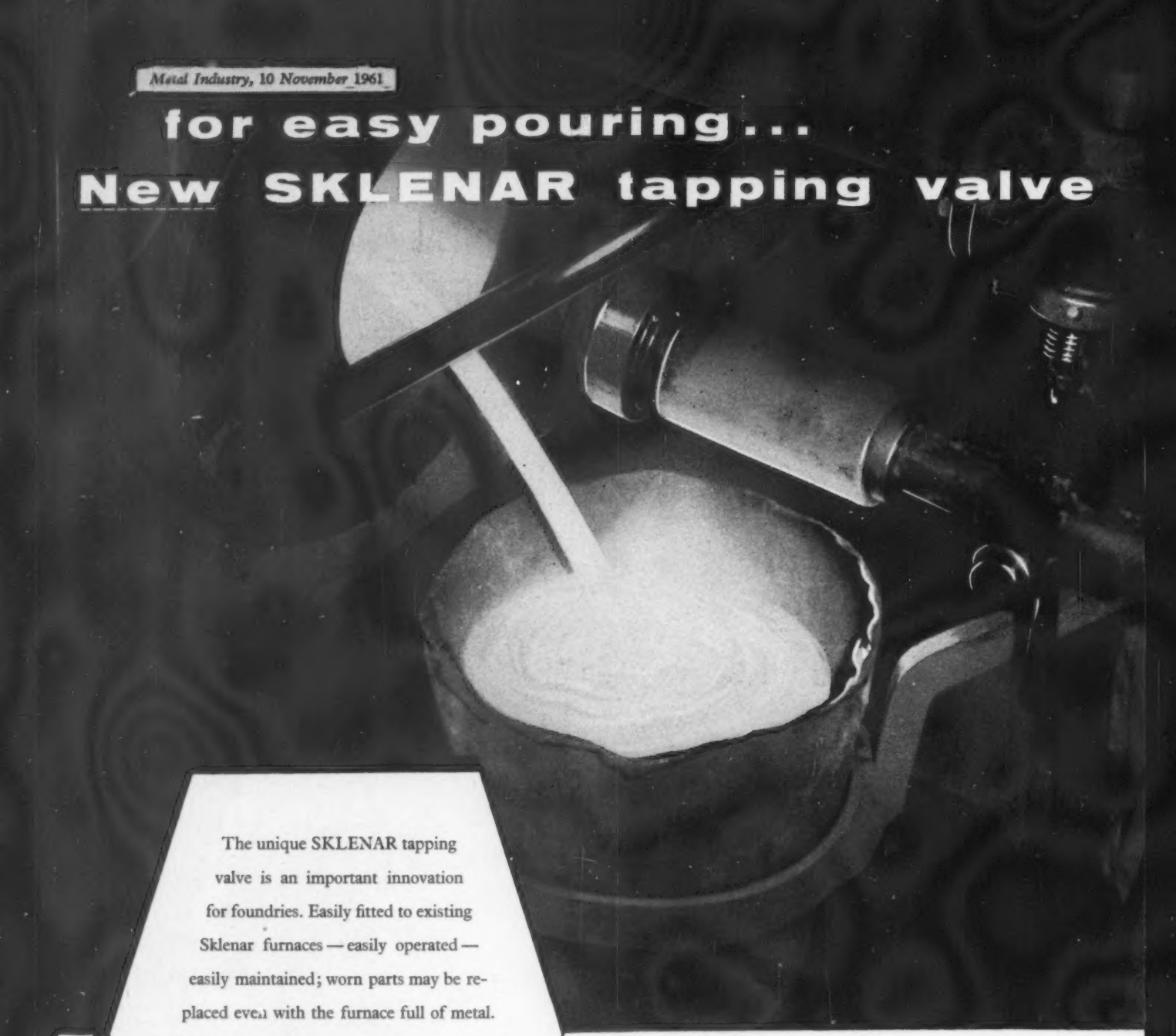

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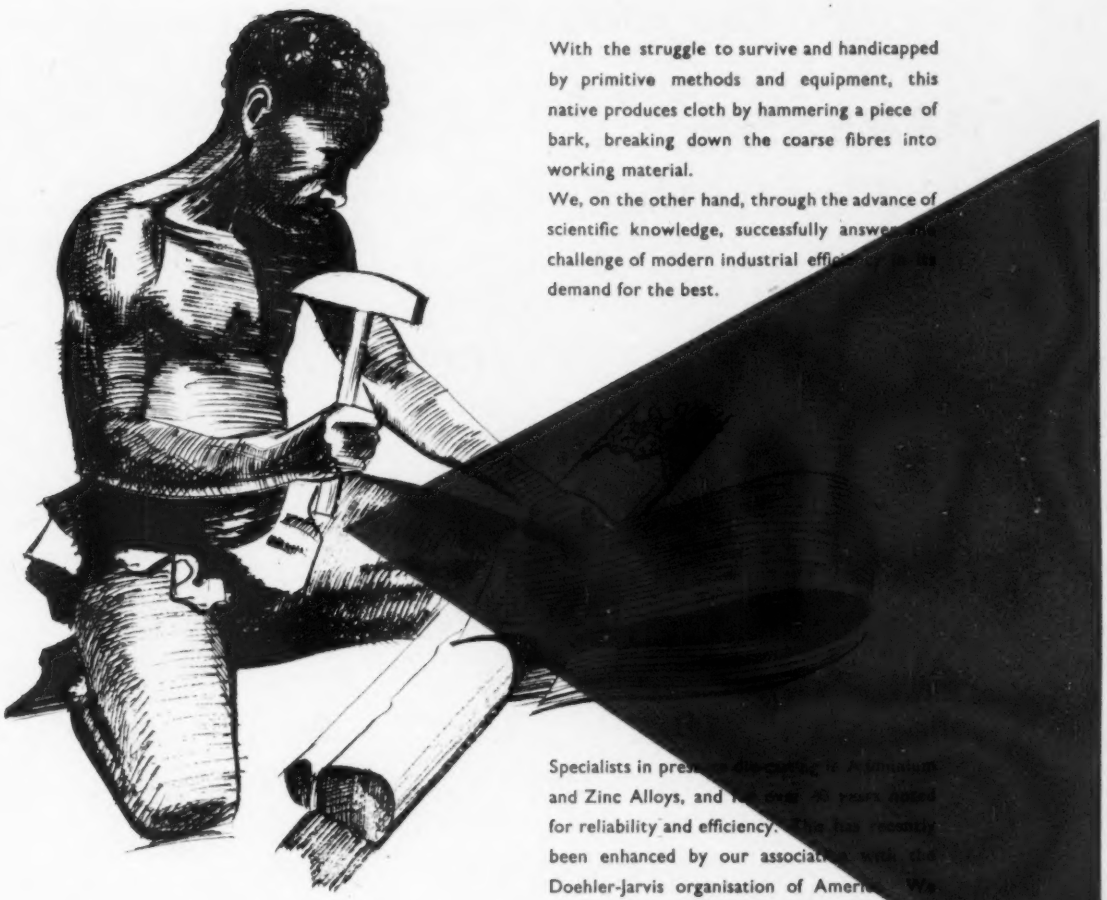

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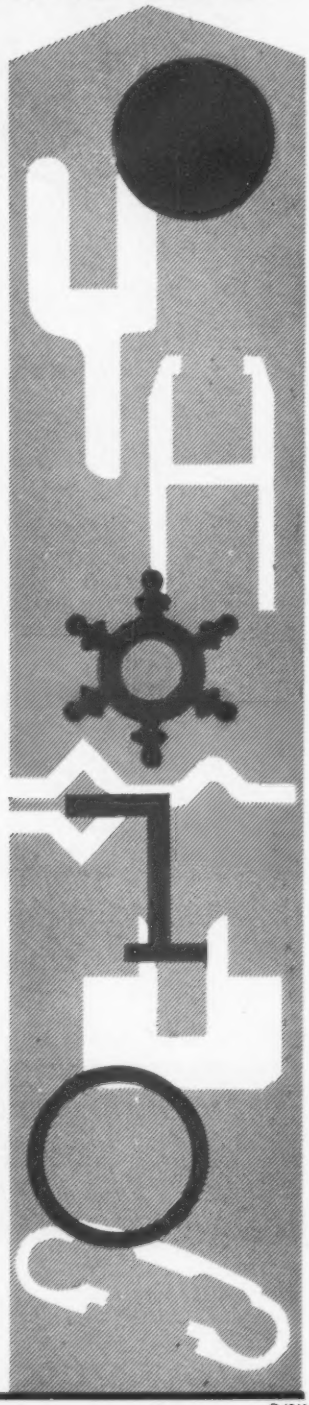

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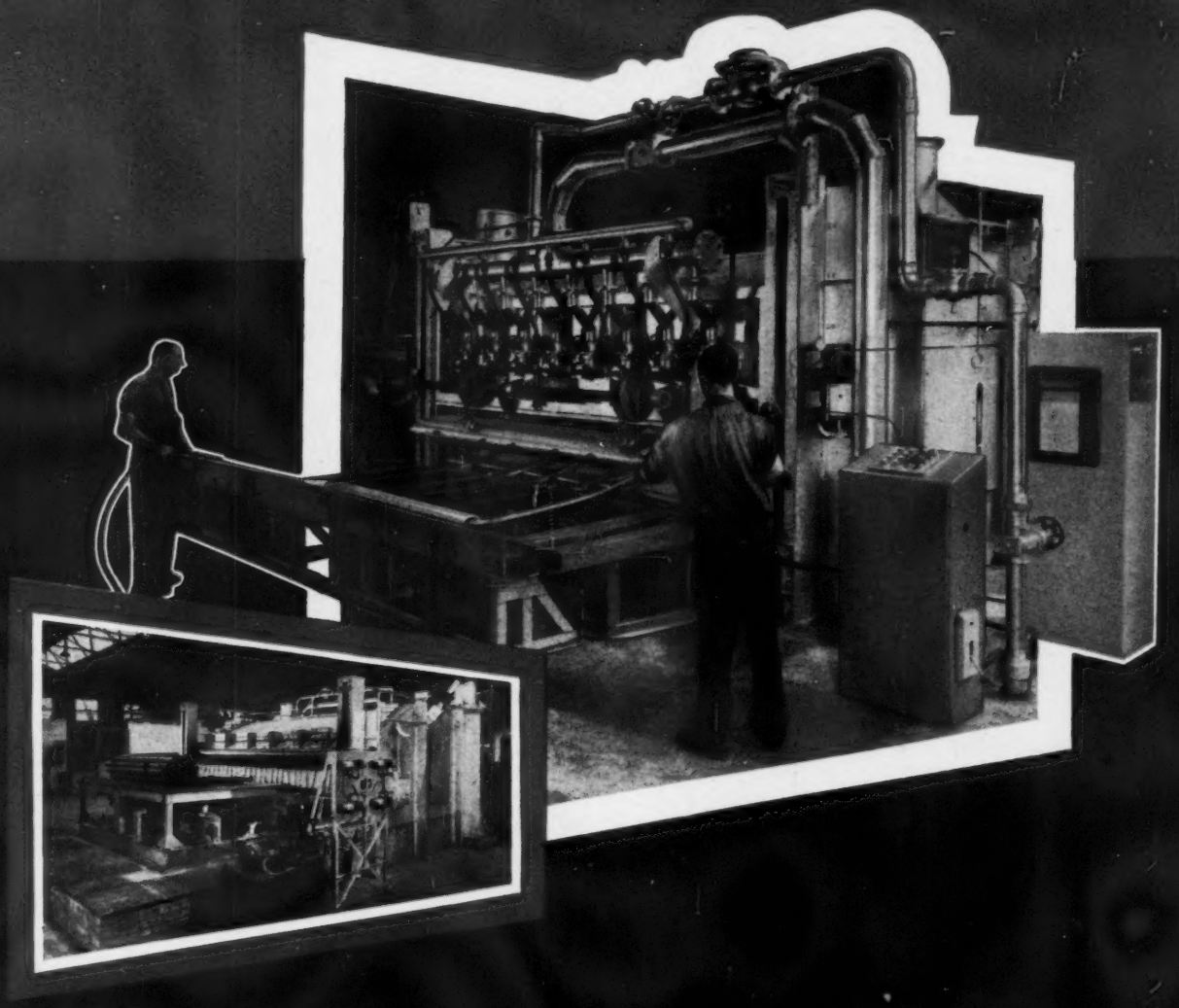

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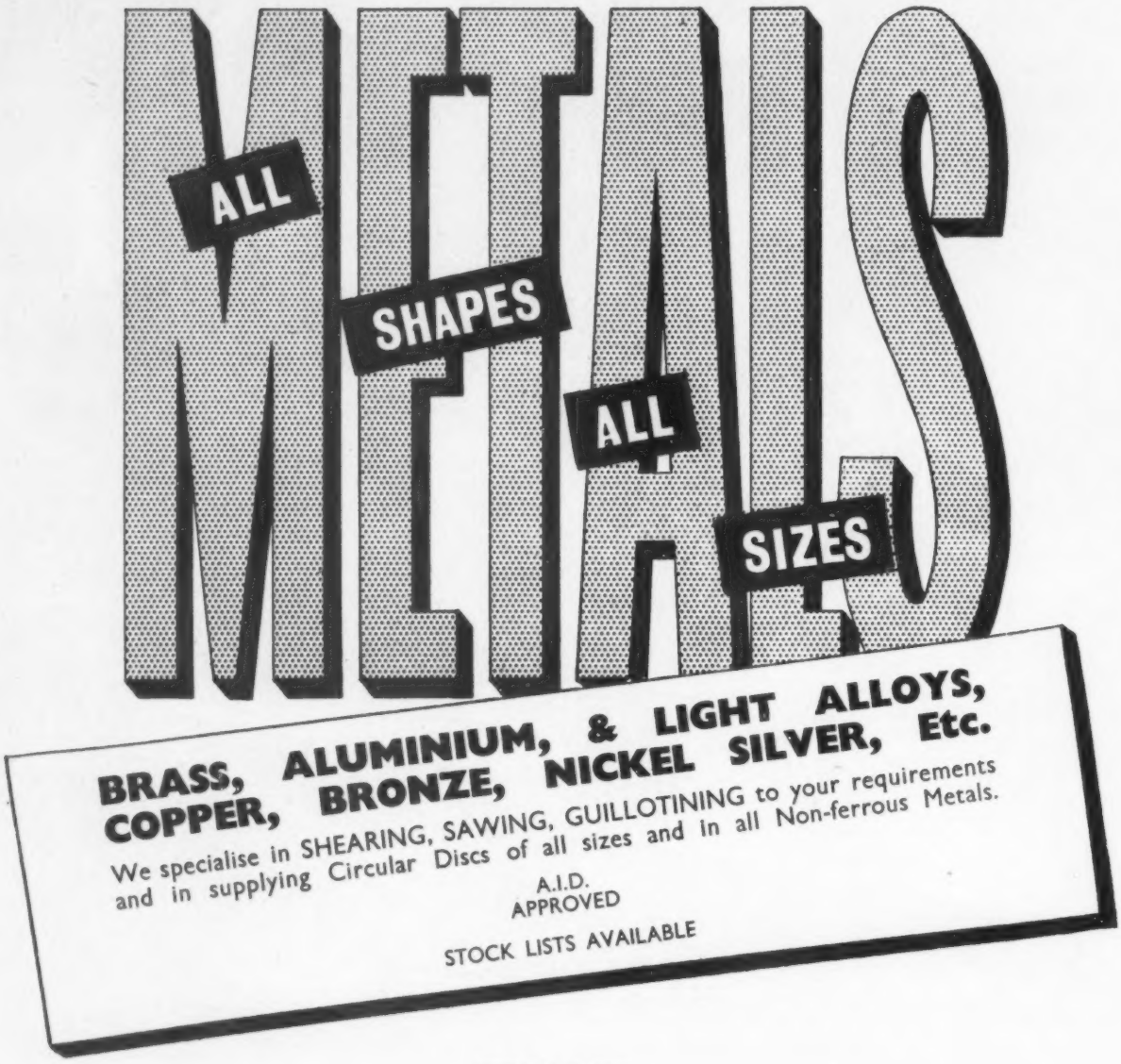

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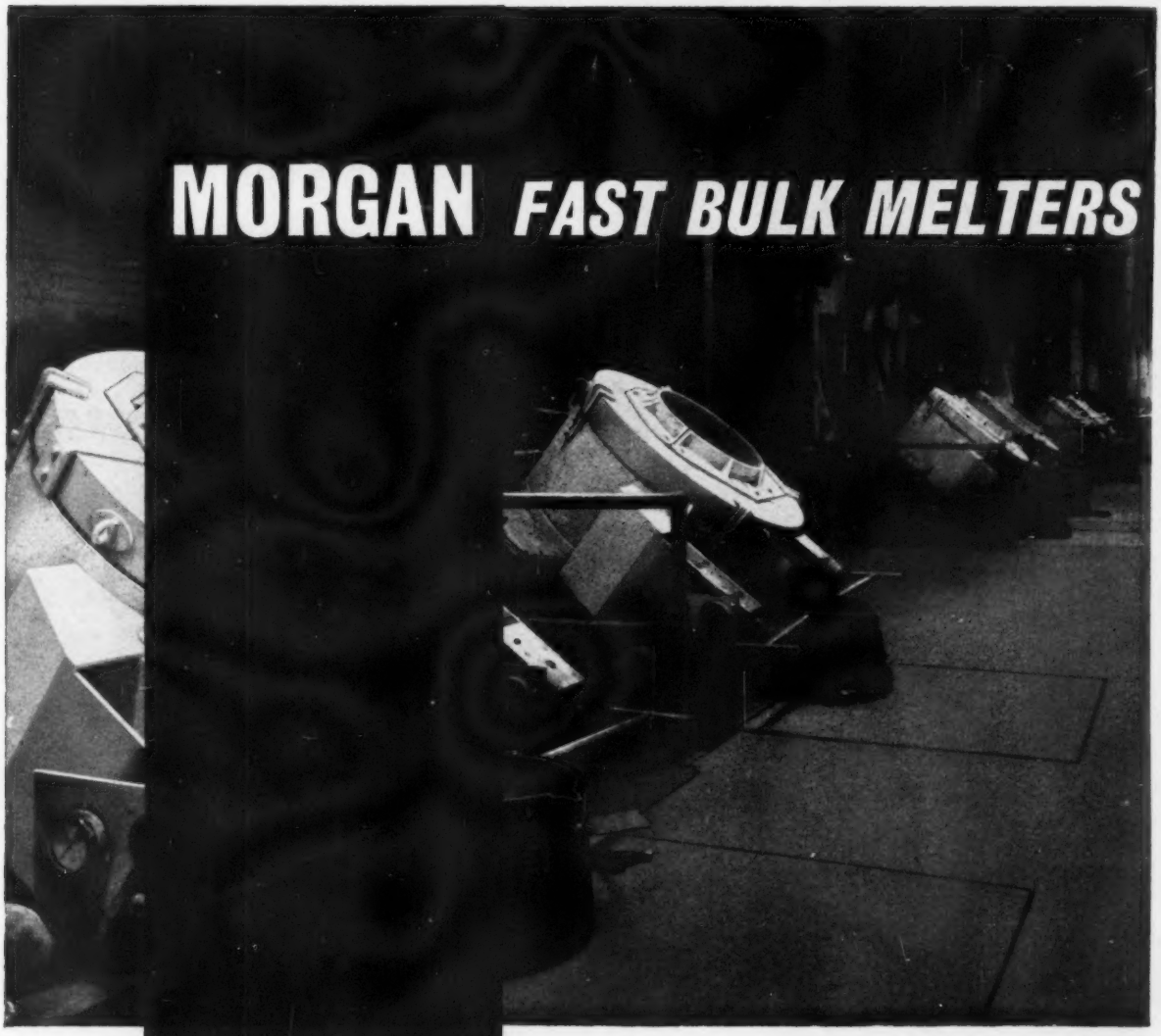

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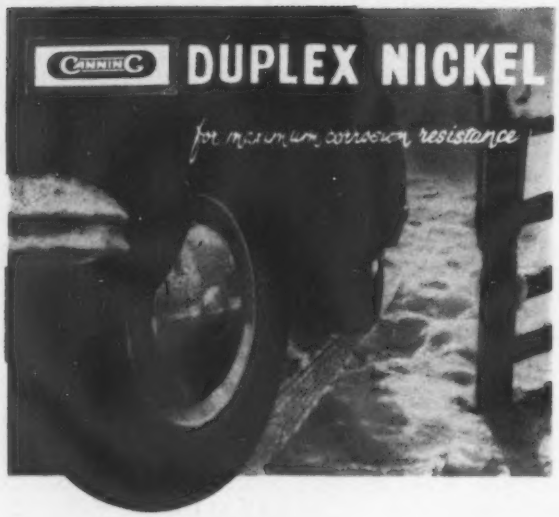

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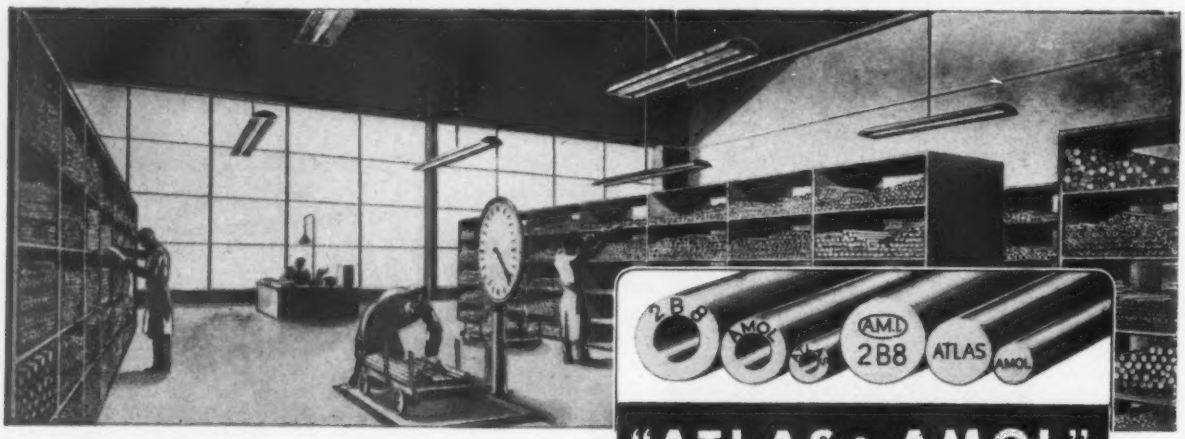

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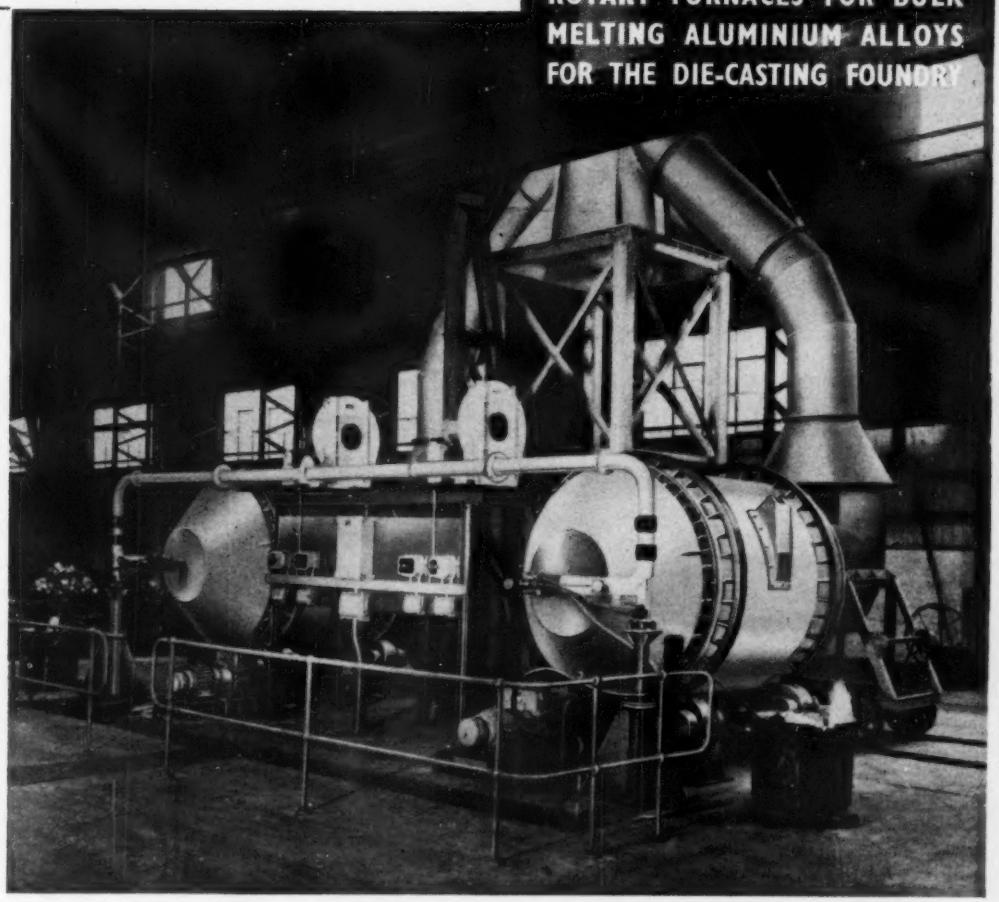

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10 NOVEMBER 1961

VOLUME 99

NUMBER 19

Industry and Education

EDUCATION is everybody's business. For this reason the interest shown by the Federation of British Industries, as evidenced by their recent statement on the subject of higher education, is to be welcomed. Since the range of executive responsibilities in manufacturing industry, which, incidentally, employs 36·3 per cent of the working population of this country, is becoming increasingly complex, it is important that higher education should prepare the potential recruit to meet these responsibilities in the right way. The higher educational system of this country, says the F.B.I., has not kept pace with the considerable changes which have occurred, over the past twenty years, in the demands made by manufacturing industry of its recruits. The greatest need of industry is for those who have profited from a well organized and more prolonged period of broadly based education. This, it is suggested, would help to meet the growing demand for young men and young women capable of forming judgments on complex matters.

Among the suggestions made by the F.B.I. Education Committee to achieve these aims is that new institutions should be founded to improve the balance of higher education. For example, there are at present serious shortcomings in the teaching of foreign languages, and a new approach to these subjects is needed, such as is provided by the Sprachen and Dolmetscher Institutes in Western Germany. It is pointed out that close association between industry and education is most clearly manifested by existing sandwich courses in technical colleges. Unfortunately, these are supported mainly by the larger companies only. It is obviously undesirable that too many students should be tied in this way. Smaller companies can make a valuable training contribution and many men can seek their career in smaller firms with more personal satisfaction. For these reasons it would be advantageous to extend the responsibility for their training throughout industry, and the Committee considers that this could be achieved by means of educational grants or by some form of reimbursement to the industrial unit sending students for training.

Recognizing that any changes in the pattern of higher education will need to be matched by corresponding changes in the supply of teachers, the Committee recommends that manufacturing industry should be encouraged to help these teaching needs by short-term or relatively long-term secondments of staff for teaching purposes. It is also suggested that exchanges between the staff of industrial research centres and academic institutions might be advantageous. Consideration should also be given to the introduction of joint appointments between industry and the academic world frequently encountered in Holland, Germany and the United States.

It is not only important that the graduates of higher education should be people who have learned how to adapt themselves to the needs of industry in which they hope to make a career, but that industry itself should recognize that it must use its graduate recruits wisely and with economy.

Die Design for Gravity Die-Casting

By W. Goode
(*Birmingham Aluminium Casting (1903) Co. Ltd.*)

GRAVITY dies are usually made from a good quality cast iron which possesses sufficient strength to resist wear and tear and, at the same time, makes possible a great saving in machining time. A comparison of Figs. 1 and 2 shows that blocks machined from the solid are still far short of the ideal shape obtained with the castings. The castings, it will be seen, have a uniform thickness of metal round the cavity which will ensure that the die remains hot without uneven chilling effects. It is true that a great deal of thermal control is exercised in operation of any gravity die, but around the impression it has been found most advantageous to maintain this uniform shell, usually ¼ in. thick, as a fundamental, and resort to local chilling, which is readily adjustable and often fulfils other functions.

The molten metal must be allowed to fill the mould in an unbroken stream without turbulence, and every precaution must be taken against the trapping of air, by carefully positioning the point of entry into the die cavity, and the provision of adequate vents.

The greatest single contribution here is due to the necessity of risers, the function of which is to feed metal back into the die, to replace losses due to shrinkage. Here again, however, they can only perform efficiently in both respects by judicious positioning both of the runner gates and the riser gates. Whilst this is a gravity casting process, a die to conform to the above requirements must have the metal constrained to rise gently, rather than fall, in the cavity; a condition accomplished, as will be seen from Fig. 3, by the pressure of following metal in the runner. Indeed, Fig. 3 shows that the runner is extended well above the cavity, not only to ensure complete formation of the risers, but also to provide sufficient head of metal to exert pressure conducive to the production of sound castings.

The designer should bear in mind in this connection that the greatest pressure will be exerted on the lower parts of the product cavity and can, therefore, influence the positioning of same in relation to the die as a whole. It would now seem to be opportune to dwell further on the question of replacement of losses due to shrinkage since this also plays a large part in determining the position of the impression. In portrayal of what is a progressive action extending throughout the casting into the riser or risers (since all but the simplest of castings will require several), a plate of uniform thickness has been chosen in Fig. 4. It will be seen that the lightest section has been placed in the lower part of the mould, the reason being that solidification will first take place here, drawing molten metal from the adjacent heavier section which, in turn, will draw upon a still heavier section above it, and, finally, the last section is compensated for losses to the other sections and the local shrinkage by drawing upon the riser, which must be the last to freeze.

This fundamental fact concerning risers, makes it possible to provide in the mould, additional local thickness of cast iron to absorb and retain heat, so delaying solidification of the risers, which, in turn, means that the bulk of the risers can be reduced to advantage. The foregoing modifies the earlier statement regarding uniform mould thickness, and, whilst on the subject, it would be as well to mention that it is also usually safe to increase thickness behind the runner, because normally the stage at which the runner freezes is immaterial, so long as the rate of production is unaffected. The extra mould metal here will enable more accurate control of the cooling of the adjacent narrow section of the plate in that what is termed a "shrink pad" can be easily machined into the mould. A shrink pad is, in actual fact, a blind riser, i.e. a riser not open to atmosphere and, when it is appreciated that the narrow section of the plate receives the last of the metal from the runner, and has given up little of its heat to the die, it will not be surprising to find this section in need of the extra feed which a shrink pad could provide.

Taken to its extreme, a decision could be made after inspection of a trial cast to machine the whole of the runner to a greater depth, in which case it would supplement its original function by subsequently assuming the role of a feeder. Although this is a contingency quite often catered for, there is a danger of its incorporation, which should not be overlooked, in that greater skill in pouring may be required to avoid turbulence of the ingoing fluid passing through the deeper channel.

The need for a check on the speed of entry, which is the cause of turbulence, accounts for the runner being set on an angle in Figs. 3 and 4, but if a greater check is needed, the use of what is termed a "horn runner" will actually change the direction of flow temporarily and is most effective (Fig. 5). There are many variations between the conventional and horn type runner, selection being governed by the degree of check required. Controlled tilting of the die as filling of the mould proceeds, is superior to the horn runner and will speed the operation, but is costly, either in manpower or mechanization, and is not warranted except where the product is heavy, long and thin in shape, and large quantities are required.

With complex dies less predictable, it may be necessary after normal pouring to pour direct into the risers and, still further, to provide local heating in the form of gas jets or lagging in order to ensure that the risers freeze last.

Another procedure sometimes adopted to maintain even die temperature, particularly if the product is symmetrical of form, is to reproduce the runner on the opposite side of the impression to serve alternatively as a vent and then as the runner.

Fortunately, the heavy sections occurring out of the general order of progression are occasioned most frequently by the necessity for bosses on the component and are capable of being chilled quite readily, so ensuring that adjacent thinner sections will not draw metal from these spots and cause the bosses to be improperly formed. Even so, such very local heavy sections (see Fig. 6) form pockets in the die likely to trap air and must be vented. In providing a vent, usually in the form of a grooved plug as shown, an excellent means of chilling is to hand. A factor to be mentioned here is the necessity for coating the whole of the impression, including runners and risers, as a protection against the erosive action of the molten metal. A side effect of this coating, now to be exploited, is to reduce the chilling effect of the cast iron mould generally. The vent plug referred to, in addition to being easily and cheaply replaced can be made in a material resistant to the erosive action of the molten aluminium; it therefore follows that the coating can safely be removed from the face and so provide the local chilling desired.

This principle is possible of application, of course, to any part of the die, but the product designer can help considerably in this respect. Before dealing

Controversy occurs on many aspects of die-casting, whether pressure or gravity, and a return to basic principles frequently creates a new line of thought from which new or modified techniques may be developed, or existing ideas re-assessed. With the object of sharing experience and ideas on die design for gravity and pressure dies, the Light Metal Founders Association recently held a Symposium on die design. This article, dealing with some of the basic concepts involved in gravity die design, was one of the Papers presented

with this aspect of the process, however, there are means of further chilling of die plugs which should be mentioned, and they are, in order of cooling capacity: (a) copper plugs; (b) finned plugs subject to air blast; (c) water-cooled plugs; and (d) plugs extended to form holes in the casting (Fig. 7), having their centres removed at a pre-determined stage in the casting cycle and quenched in water. The whole of a plug would not be removed because as a solid member subject to sudden shock, it would be prone to early failure at the point of abrupt section change. Furthermore, the bush part of the plug, as a fixture, provides an excellent reactor to the sharp jolt on the centre piece necessary to extract it cleanly from the casting which, due to contraction, is currently gripping this core very tightly. This occurs despite the fact that an appropriate amount of taper in the right direction (see Fig. 7) must exist on the core as a feature of casting design, otherwise tearing of the part will ensue.

Indeed, this is a feature which the product designer, if mutual benefit is to be obtained, must constantly keep in mind because such taper is essential on all cores and on the great majority of other surfaces, as will be shown. Whilst this taper may be varied to suit the consumer's requirements, it cannot be over-emphasized that with the reduction of taper, costs are bound to soar. Die design features of all movable cores should include a step between the large end of the component form and the shank of the core, such that the hole in the die will pass the coated part of the core freely without damage (see Fig. 7). Such provision is essential, since this same part of the core, even if uncoated, is subject to initial growth, very slight, but sufficient to cause seizure during extraction from the die in view of the very close fit existing between the shank of the core and the die, in the interests of dimensional stability of the product.

In further protection of the coating, cores removed from the die are best suspended on some convenient rig on the worktable away from the working area until again required. Hooks for this purpose should be attached to the core. On large cores operated by rack and pinion or air cylinders, their position at all stages is predetermined by die design. Such cores are headed in the same way as small cores, since the initial break is accomplished in the same manner by levering under the head. Coating of the whole impression means that careful watch must be kept to ensure that the act of parting the die does not itself remove some of the coating; in fact, a step in the joint may sometimes be necessary.

Of increasing importance as the complexity increases in step with the demand for still greater dimensional stability of gravity cast products is the necessity, especially in the case of the larger castings, to guard against the inadvertent coating of die joints. Measures to this end invariably create problems for the die designer and increase die cost, this, nevertheless, being representative of a diminishing proportion of the total die cost. The contingency arises when the die-caster is uncertain of the precise area to be coated of certain die faces, i.e. those which at some point cease to be joint

Fig. 1—Die blocks produced as castings provide uniform thickness of metal around the die cavity

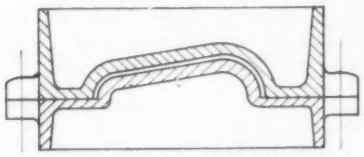


Fig. 2—Die block machined from solid, showing typical variations in section

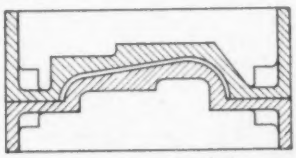


Fig. 3—Arrangement of runner and riser to provide gentle pressure on inflowing metal

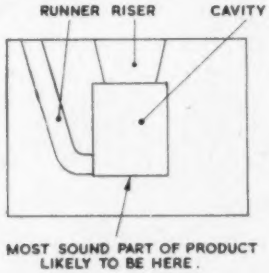


Fig. 4—Placing of cavity for typical irregularly shaped plate, with shrink pad adjacent to the narrow section of the plate

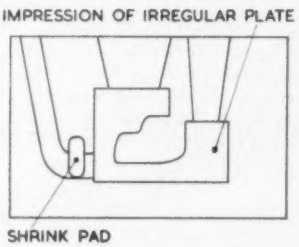


Fig. 6—Where heavy sections occur, as at bosses, a grooved plug can usefully serve as a local chill

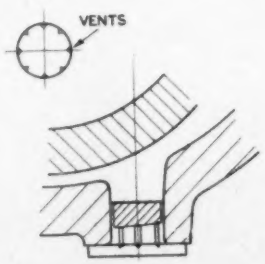


Fig. 5—To check the speed of entry of molten metal into the die cavity a horn-type runner may be effectively used

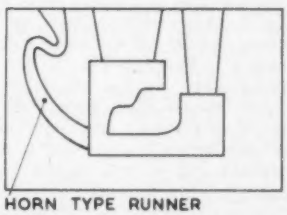
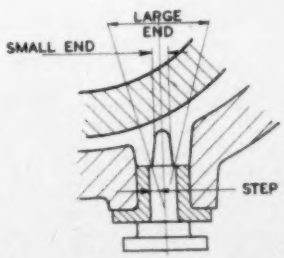
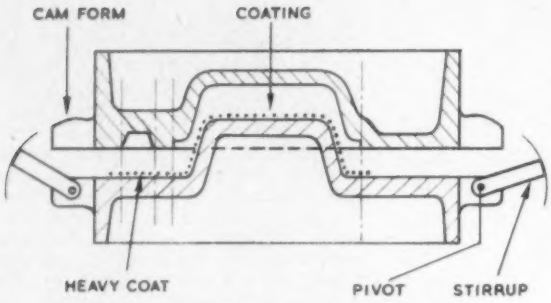
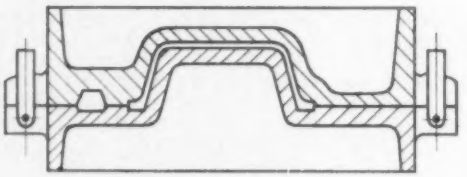


Fig. 7—Various modifications of chill plugs can be adopted. In this case the inner end forms a core to produce a hole in the casting

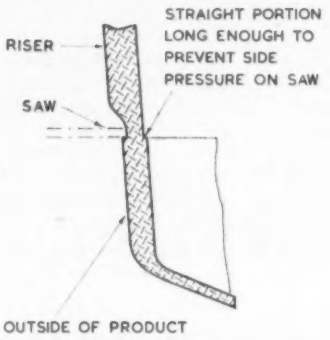




Left: Fig. 8—Cam and stirrup type closure for die halves



Below left: Fig. 9—Cavity formed in both halves to ensure complete die closure



Right: Fig. 10—Formation of riser to ensure ease of removal

faces and extend to form a casting face or, more frequently, the face of the runner, or a riser.

Reference to Fig. 8, depicting a plain, two part die with an uncomplicated product impression, intentionally so for the sake of clarity, will demonstrate the caster's difficulty. At the same time, it will be immediately clear that such cases must be very numerous, as indeed they are, and it will be seen that unless safeguards are provided complete closure of the die will be impossible. It will readily be appreciated that parts most prone to give rise to this condition, namely, runners and risers, invariably receive a thicker coating (their dimensional stability being unimportant) and the period of fluidity of the metal in the risers is thereby extended. The question as to the means of keeping the mating faces of a joint tightly closed whilst making the castings, is now relevant, and by far the most common method is included in Fig. 8. On each of the mould castings there are two or more integral lugs, some fashioned to receive the hinge pin of a stirrup, others having a cam form across which the closed end of the stirrup moves. Obviously, it is arranged that one of each type is mated at die closure, and as the stirrups move over the cams, increasing pressure is exerted to close the die. To sustain such pressures, the faces brought together must be perfectly flat and free of high spots such as would occur if coating material intervened. Otherwise, at best, the die parts would be distorted or, worse, the parts would fracture.

The steps to be taken in this hypothetical case are fairly obvious, and Fig. 9 shows these incorporated with little trouble. In effect, the joint has been raised so that the profile of the product is reproduced in both moulds, no dimensional change being made to the impression, and the runner has also been cut in both moulds. As stated, in this simple set-up there would be no design problems, but some cases involve stepping of the joint and, in other cases, alteration or malformation of some parts of the casting where such measures are acceptable to the customer. It often happens that the adoption of such remedies would create an undercut in the die, elimination of which would involve unacceptable modification to the product, in which case there would be only one remedy, and that outside the control of the designer. The method used in the foundry with which the writer is connected, is first to coat the whole of the particular joint face concerned, make a cast, then with the die parted and the dummy moulding so produced placed in position on the die part in need of treatment, remove the coating by scratch brushing joint faces, which will then be exposed.

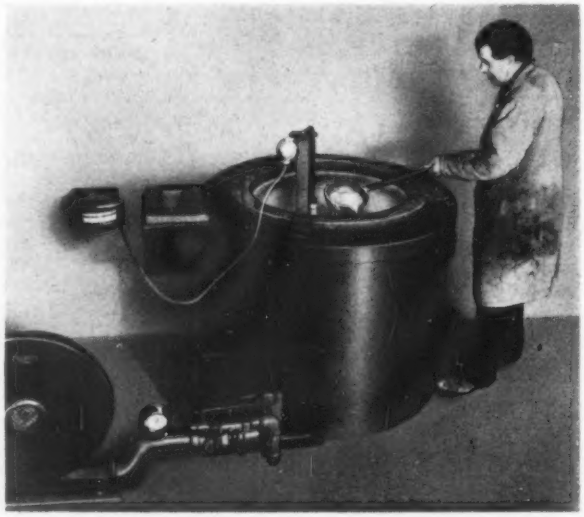
Another need which the designer must seek to satisfy concerns removal of runners and risers from the product of the foundry. This, being accomplished by band sawing, means that not only must the sawyer be quite certain where to make the cut but, further, the parts to be severed must be of such a form as to make quite certain that the saw will maintain a true course and not be constrained to wander or kick to the detriment of the casting, and danger of the sawyer. Fig. 10 shows a properly formed riser and is self-explanatory, except to say that the internal step shown is irrelevant, being, as it is, a coating relief extended into this field to limit die costs.

(To be concluded)

Melting Zinc Alloys

DESIGNED especially for die-casters and others melting zinc alloys, a range of crucible furnaces, with capacities from 100 lb. to 4,000 lb., has been introduced by Lees Hall and Sons Ltd., Newhaven, Sussex. These furnaces are tangentially fired by single forced draught gas or oil burners. A special flanged heat-resisting iron crucible is fitted and, if required, automatic temperature control can be arranged.

Central or lip-axis tilting can be arranged when required for feeding other bale-out furnaces, or direct feed to die-casting machines can be fitted.



Zinc melting furnace for die-casters, fitted with the Lees-Hall auto control unit F2

Platers' Problems

Platers and their customers are beset by innumerable problems, and in this series of "question and answer" articles some of these problems will be presented and one solution offered. Readers are invited to suggest, for subsequent publication, other means of overcoming these difficulties satisfactorily

*We are trade platers and we have been approached by a number of our customers for a bright chrome finish to B.S.*1224. *What steps should we take in order to ensure that we can be reasonably certain of meeting this Specification? What would be our liability if, in spite of our efforts, a plated component is tested by the user and found to be outside the specification?*

It is reassuring to receive this question and to know that serious consideration is being given to the problems of specification electroplating.

The first thing to ascertain is what the customer has in mind; does he require a finish which is guaranteed to conform to specification requirements in every particular?—or does the customer merely require a reasonable plated finish? The difference in cost between a reasonable plated finish which generally conforms to the specification and one which is guaranteed and tested, is likely to be quite considerable.

Considering the specification B.S.1224 in detail, its basic requirements are: (i) a given minimum thickness of deposit; (ii) a good quality deposit; (iii) a proved resistance to corrosion.

Thickness Requirement

To apply a deposit of nickel which conforms to B.S.1224:1959 and, for example, Classification Ni 12 S, it is not sufficient to plate for 36 min. at 40 amp/ft^2 and then assume that because an average thickness of 0·0012 in. may well have been applied, that the finish conforms to the specification and qualifies for the appropriate quality label. The specification calls for a given minimum thickness of deposit on the significant surface of the article to be plated—a very different matter.

There is generally a considerable variation in the thickness of the deposit over the surface of an article and, in addition, there are liable to be variations between articles on different positions on the jigs and between one position in the plating tank and another.

The specification rightly places the stress on a given minimum thickness as failure *usually* occurs where the coating is thinnest. Large variations in thickness are wasteful both in time and in material, as the average thickness applied has to be considerably increased to ensure that the minimum thickness requirement is met.

It is usual to apply an average thickness of 25 to 50 per cent in excess of the minimum specification requirement but, even so, close attention must be paid to the positioning of articles in the plating tank. It may well be necessary to redesign the plating jigs, increase the anode/cathode spacing or even reduce the number of articles per load in order to obtain a fairly even distribution of deposit.

Thus, with the arrangement of Fig. 1, which shows a section of a conventional 3 ft. wide plating tank with 2 cathode and 3 anode rods, the outer surfaces of the articles being plated may be within 3 in. of the anodes.

The minimum anode-cathode spacing shown in Fig. 2, which is a section of a 4 ft wide tank with 2 cathode and 3 anode rods, is almost twice that obtainable in a 3 ft. wide bath. The possible variation in anode-cathode distance has also been reduced from 2:1 to 1·4:1; an important factor, particularly where high-speed electroplating processes are employed. Fig. 2 also illustrates the effect of increasing the cathode spacing and reducing the anode spacing—two additional ways of improving the uniformity of the plated deposit.

Thickness Determination

It is rarely possible to calculate the exact distribution of the deposit; it is, therefore, necessary to carry out thickness tests to ensure that the required thickness of deposit is being applied.

Thickness testing itself is quite a problem, particularly for the smaller plater. Micrographic methods require considerable experience and the use of refined techniques. The Jet Test method, though still widely used, is of doubtful value for bright nickel

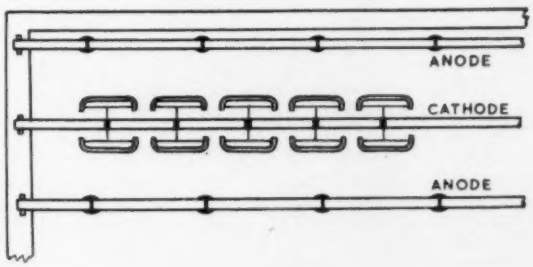


Fig. 1—Section of a conventional 3 ft. wide plating tank with 2 cathode and 3 anode rods

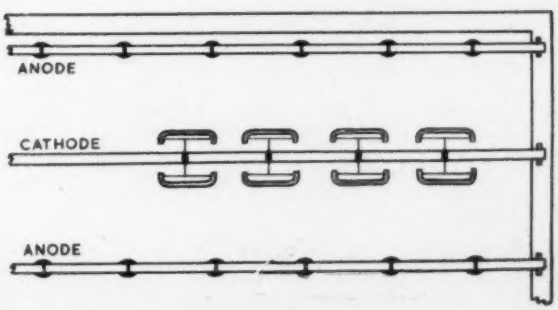


Fig. 2—Section of a 4 ft. wide plating tank with 2 cathode and 3 anode rods

deposits unless standardized for the particular plating solution in use. The most suitable method would appear to be the coulometric method. The "B.N.F." coulometric instrument (see METAL INDUSTRY, 9 June 1961, p. 455) provides a test which is simple to apply, rapid and accurate in use and can be applied to any type of nickel deposit—bright, semi-bright or dull—without the need for the application of a correction factor.

Quality Deposits

There is more to producing a lasting finish than merely applying a specified thickness of deposit. The coating must be free from surface imperfections such as blisters, pits or unplated areas, and have good mechanical properties without brittleness or excessive stress.

The first essential is that the plating solutions be in good condition and this necessitates effective equipment with adequate filtration and uniform agitation. A regular check should be made on anode bags to ensure that they are free from holes through which particles may pass. The electrical equipment, too, requires to be regularly inspected and ammeters checked to ensure that they are accurate—faulty meters are an all-too-frequent cause of inaccurate plating.

The plating solutions themselves must be kept in balance and operated in accordance with the recommended procedure. Frequent small additions of chemicals are generally to be recommended so that only a minor adjustment is necessary when the solution is analysed. After a solution has been in use for a period, it is possible to estimate the additions necessary quite accurately.

Special attention must be paid to the preparation of the surfaces to be plated. Polishing should be to a high standard and the polished articles free from excessive amounts of polishing composition. A little care here can greatly simplify the subsequent cleaning stages. The cleaning cycle should be selected to suit the material to be processed and maintained in optimum condition.

Effective surface preparation is probably the most important stage in specification plating and no attempt should be made to economize here. Many plating difficulties stem from failure in the cleaning stages.

Corrosion Resistance

A number of accelerated corrosion tests are included in B.S.1224:1959, but in spite of the very considerable amount of research which has been undertaken on this subject, the interpretation of results still requires considerable experience, and it is difficult to relate accelerated tests to the expected service life of the finish.

Despite their limitations, accelerated tests are extremely useful in detecting sub-standard finishes which are likely to fail in service. Premature failure under test of a plated component may not, however, be due to any fault in the electrodeposit but may arise from defects in the metal from which the article is made.

The Cost of Failure

Where the customer is a large manufacturer, and every batch of work is tested, failure to meet the requirements of the specification would merely involve the return of the work for reprocessing. The problem is much more complicated where the customer accepts the plater's assurance without test. The average person, not unnaturally, expects the plated finish to last the life of the article, especially where it is backed by a British Standard. It is, therefore, possible that complaints may be made after a considerable period of use, and unless the plater can show that all reasonable efforts were made to meet the requirements of the specification, heavy claims for damages might have to be met.

Electroplating to specification is not a thing to be entered upon lightly. It requires the close co-operation of the plater and his customer. It is, however, essential for the continued development of the plating industry that standards be raised and public confidence in plated finishes restored.

Protection Against Metal Fatigue

SIGNIFICANT reduction in the rate of fatigue crack propagation through specimens of aluminium and copper-beryllium alloy is achieved by the presence of an organic liquid such as dodecyl alcohol on the test section. A recent study made by the U.S. National Bureau of Standards to investigate the role played by surface reactions in fatigue failure has yielded some interesting results.

Fatigue failures are progressive and consist of two phases, the first, crack initiation, extending from the start of the stress application to the appearance of the first crack (which ultimately causes specimen failure); the other, a period of crack propagation, which terminates with the abrupt fracture of the piece. In a laboratory test the duration of each phase depends on the type of specimen used. In earlier work with smooth cylindrical specimens it was found that the presence of certain polar organic liquids on the surface of the specimens increased the fatigue strength of several metals. This improvement was primarily a measure of the effect of the liquids on fatigue crack initiation, since a large portion of the total life of the specimens had been expended before cracks appeared. The reason for the improvement was thought to be that the polar compounds formed films on the metal which prevented deleterious reactions between the metal and the atmosphere.

To obtain information on the effect of such compounds on the crack propagation phase, fatigue tests were conducted with sharply notched cylindrical specimens in both a clean condition and with dodecyl alcohol on the surface. The notches serve as stress raisers; as a result, the effective stress at the root of the notch greatly exceeds the nominal stress applied to the specimen, and cracks appear at the notch at an early stage of fatigue life.

In the study, tests were conducted on specimens of 4340 steel, 17-7 PH stainless steel, 6061 aluminium alloy, and a copper-1·75 per cent beryllium alloy. They were 0·365 in. in diameter, and notched around the middle to a reduced diameter of 0·250 in. To prevent variations in surface finish and in the amount of cold work produced in the surface of a specimen, the 0·005 in. radius at the root of each notch was carefully ground. All the tests were run on rotating-beam machines of the R. R. Moore type, operated at 3,000 r.p.m.

To determine the approximate point in the fatigue life when cracks first appeared, fatigue specimens of each metal were tested for small percentages of their expected fatigue life, and longitudinal sections of the specimens were examined metallographically for cracks. An analysis showed that the approximate portion of total fatigue life expended before cracks appeared was 5 per cent for the steel and aluminium; 10 per cent for the copper-beryllium alloy; and 35 per cent for the stainless steel.

Specimens to be tested in the coated condition were first stressed in the clean condition for the duration of their crack initiation period, and then, for the remainder of the fatigue life, dodecyl alcohol was dripped into the notch. The results of these tests are given in Table I. Data for all four alloys show that the duration of the crack-propagation period at two stress levels was increased by the dodecyl alcohol coating.

TABLE I—EFFECT OF DODECYL ALCOHOL ON FATIGUE CRACK PROPAGATION

Material	Nominal Stress Amplitude (lb/in²)	Stress: Thousands of cycles						Ratio Np Values Coated/ Clean
		Clean			Coated with dodecyl alcohol			
	1000	Nf*	Nc†	Np‡	Nf*	Nc†	Np‡	
4340 Steel	32·5	210	10	200	586	10	576	2·9
	55	33	2	31	63	2	61	2·0
Copper-Beryllium Alloy	30	749	78	671	3406	78	3328	5·0
	50	27	3	24	39	3	36	1·5
6061-T6 Aluminium	11·5	358	18	340	632	18	614	1·8
	17	81	4	77	120	4	116	1·5
17-7 PH Stainless Steel	42·5	115	40	75	325	40	285	3·8
	52·5	32	12	20	39	12	27	1·4

*Nf = *Median fatigue life (5 to 7 specimens)*
†Nc = *Number of cycles required to produce a detectable crack*
‡Np = *Nf—Nc (crack propagation portion of fatigue life)*

The results indicate that the coating, by limiting the access of molecules of oxygen or water to the metal surface, reduces the rate of detrimental surface reactions that normally occur when specimens are stressed in air. Two materials, the aluminium and stainless steel, showed a greater beneficial effect with notched specimens than they did with smooth specimens in the earlier study. This result may be associated with the relatively impermeable and adherent oxide films that form on these metals. Prior to crack initiation, these films apparently minimize detrimental surface reactions. During the crack-propagation phase, however, each increment of crack extension provides an area of clean metal surface that may react with any oxygen in the atmosphere.

While these considerations provide a possible explanation for the effects of dodecyl alcohol coatings on crack initiation and propagation, the mechanism of the effect of surface reactions on fatigue is still not clear. Recent work, both at the Bureau and elsewhere, tends to show that the oxygen and the water vapour in the atmosphere are responsible for the reduction in fatigue life.

MEN and Metals

Chairman and managing director of W. C. Holmes and Company Limited, **Mr. F. Brian Holmes,** M.Inst.Gas E., retired as managing director at the end of last month, but will retain his chairmanship of the company, of the holding company, B.H.D. Engineers Limited, and of those member companies of which he is at present chairman. Mr. Holmes is succeeded as managing director by **Mr. A. J. M. Henshaw,** M.A., who joined the company in 1946 and was appointed to the board in 1953. **Dr. W. T. Cosby,** B.Sc., Ph.D., M.Inst.F., who joined the company in 1950, has been appointed to the board.

It has been announced by the directors of Morris Ashby Limited that **Mr. W. H. Chambers,** having completed over 51 years' service with the company, has now retired. Mr. Chambers first joined the company in London in 1910 and, following a period of service in Liverpool, moved to Hull in 1924, where he has represented the company and their associates Columbian International (G.B.) Limited, to date. He is being succeeded in this area by **Mr. R. P. Bartrum,** who is moving from Leeds after having served in London and Birmingham.

It is understood that **Mr. R. E. Ansell** has become sales director of Henry Wiggin and Company Limited, and **Mr. C. Bowles** has been appointed sales manager.

At the annual general meeting of the British Valve Manufacturers' Association, held in London, the following officers and executive committee were elected for the year 1961-62 :—**Mr. A. Robertson,** chairman; **Mr. F. Burgess,** vice-chairman; executive committee—**Mr. D. Bailey, Mr. B. S. Bass, Mr. D. S. Birkett, Mr. W. R. Blakeborough, Mr. F. S. Ham, Mr. H. R. Hammond, Mr. K. M. Leach, Mr. N. P. Newman, Mr. T. B. Pattison, Mr. A. L. Trump,** and **Mr. R. F. Walker.**

Appointed a managing director of the Tube Investments group last month, **Mr. R. D. Young** has been appointed to the board of Raleigh Industries, another member of the group.

Chief scientist of the Kelvin Hughes division of S. Smith and Sons (England) Limited, **Mr. W. Halliday** has been appointed a director of the division.

At a board meeting of Osborn-Mushet Tools Limited, held recently, **Mr. B. Smith** was appointed a director of the company.

Chairman and managing director of Moon Brothers Limited, of Birkenhead, **Mr. R. B. Moon** has left on an extensive tour of South America, during which he will visit Argentina, Brazil, Bolivia, Chile, Colombia, Equador, Paraguay, Peru, Uruguay and Venezuela.

Two new directors have been appointed to the board of Stanley Works (G.B.) Limited. **Mr. Arthur G. Jones,** general works manager, has been appointed works director, and **Mr. William R. Mills,** general sales manager, has been appointed sales director. **Mr. Warwick M. Dingley** has relinquished his seat on the board in view of his increasing commitments as director of marketing in Europe for the whole of the Stanley international organization.

A new appointment within the Amber group of companies is that of **Mr. G. J. Hooper,** who has joined D. A. Stuart Oil Company (G.B.) Limited as applications manager. In this new position he will be primarily concerned with the sale of cutting oil bases compounded at Wolverhampton by the company.

At present sales manager of the furnace department of The General Electric Company Limited, **Mr. C. J. Evans,** A.M.I.E.E., has been appointed southern area sales manager of Efco Furnaces Limited. He will take up his new appointment on December 1 next.

Appointed a joint general manager of Elliott Brothers (London) Limited, **Mr. W. G. Bond,** who joined the organization at the age of 14, thirty-one years ago, has been responsible for the mechanical handling, conveying and industrial weighing activities of the company for a number of years.

Products and Processes

Trends in the Development, Application, Processing, Design and Working of Non-Ferrous Metals and their Products

Check Weighing Improves Zinc Slabs

IN THE production of aluminium, brass, copper and zinc sheets at the Middlesex works of Enfield Rolling Mills Ltd., the basic slab must be of the right size and weight before the rolling process begins.

In the manufacture of zinc sheeting, for example, ingots delivered from the smelters are fed by hydraulic ram into the crucible chamber of an automatic casting machine, from whence the molten metal is poured into moulds. These moulds, mounted on a continuous belt, receive a pre-determined weight of metal from the crucible; the timing of delivery is so arranged as to give time for the dross to be skimmed before the cycle is repeated.

After cooling, the slabs are conveyed to a "holding furnace" where they await transition to the rolling mill; but inspection is necessary after casting, to ensure that the weights are within a half-pound tolerance. An overweight slab can break the rolls.

Initially, checking at Enfield was intermittent; slabs (some weighing up to 90 lb.) were lifted at random from the conveyor and weighed on an adjacent scale. This system, which not only placed a serious responsibility upon the operator, also failed to provide a continuous check on any aberration of the casting machine.

Today, the erratic check is replaced by individual check-weighing of every slab as it leaves the casting machine. The installation of an Avery scale in the conveyor line has simplified and speeded up this operation, and made check weighing a step in the continuous process.

A straightforward triggering system operates a jack, which places each cake automatically in the weighing position, and the weight—readable up to 150 lb. in half-pound divisions—is registered on the dial of the scale. After weighing, the conveying sequence continues: the weighing time is 22 sec. Something like 1,200 slabs are weighed each day, plus 800 on the night shift. At 2,000 separate weighing operations each 24 hr., working in a temperature of 104°F., this scale, standard except for higher viscosity oils to counteract the operating temperature, has required no more inspection than that laid down under normal service contract of three times a year. This is a more severe test than that which is given to a factory prototype: but upon the reliability of the scale rests the whole satisfactory sequence of production.

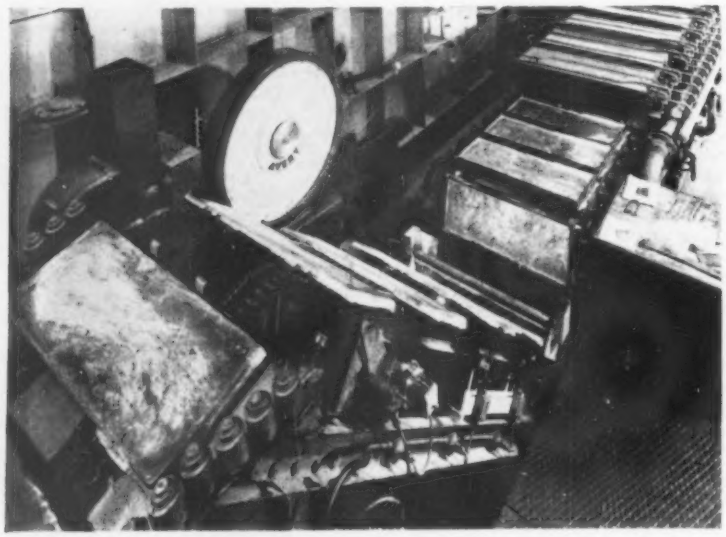
Removing Ferrous Particles from Fluids

FOR the extraction of ferrous particles of micron size from machine tool coolants, clay slurries, oils and other fluids, Rapid Magnetic Limited have recently introduced a magnetic filter which is simple to install and very easily cleaned, whilst no running costs are involved. It is well known that if such contamination—abrasive in its effect—be allowed to remain, it can cause rapid wear of machine tools, and also result in blemished components. The filter is intended for installation in the pipelines of the machine or process system.

Versatile Dust Control

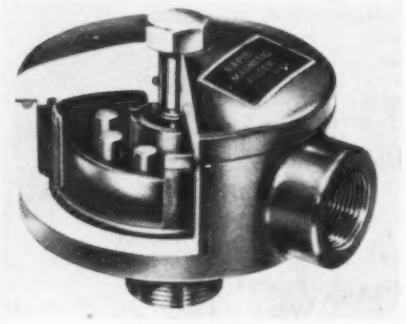
WITH no mechanical moving parts, the Dallow Lambert "Dalamatic" automatic fabric dust collector incorporates an integrated system of standard filter units in such a manner as to enable installations to be assembled capable of handling air volumes of the order of 100,000 ft^3/min.

In simple form, the unit may consist of one, two or three tier assemblies. Each tier contains nine pad type filter elements with a fabric area of 60 ft^2. In operation, contaminated air is entrained into the filter above the level of



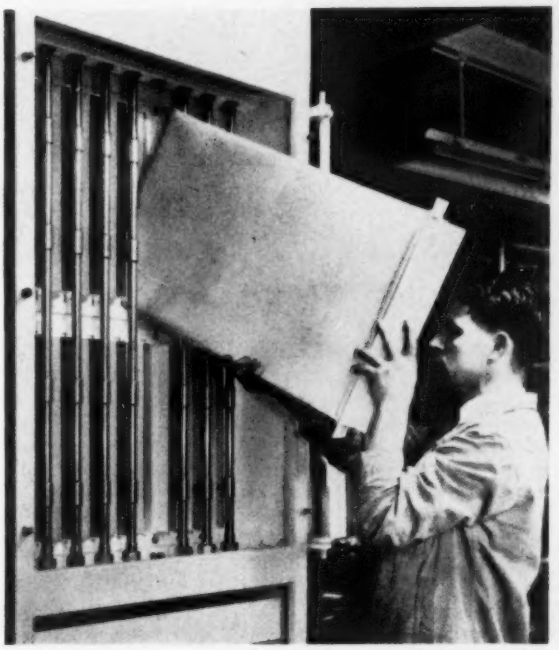
Left: Avery self-indicating platform scale installed in the zinc slab casting line at Enfield Rolling Mills Ltd.

Below: Filter produced by Rapid Magnetic Ltd. for extracting ferrous particles from fluids



filter elements, passes downwards between the elements and is filtered into a common outlet header running the height of the filter. Dust initially retained on the filtering medium is removed in an orderly and controlled manner to the hopper below the filter, and is eventually discharged by means of a rotary seal or other conventional methods. In applications with a heavy dust or product burden, a primary separator is integrated within the filter hopper, so avoiding any tendency for fabric abrasion to become a significant factor.

Multi-assemblies of the unit can be achieved in a side-by-side arrangement, back-to-back, or a combination of both. The maximum fabric area of a single unit is obtained by three tiers, giving, at present, 180 ft^2 of fabric. Multi-assemblies increase filtration area accordingly. Filtration velocities are high and a single three-tier assembly would have a continuously rated gas throughput, on average, in the order of 2,000 ft^3/min., varying from 1,000 ft^3/min. for dusts with obnoxious filtration characteristics to more than 3,000 ft^3/min. for dusts with benign behaviour.



Removing one of the pad filter elements from a "Dalamatic" tiered dust collector assembly

Lead-Polythene Mixture as Radiation Shield

A LEAD-POLYTHENE mixture, primarily intended for use as a shielding material for the attenuation of gamma rays and neutrons, enables containers for radioactive materials to be readily formed and machined. It consists of finely divided metallic lead powder uniformly dispersed in polythene, and intricate shapes in a range of thicknesses can be supplied with an accurately machined finish.

A typical mixture contains five parts lead to one of polythene by weight. This product has the following properties: sp. gr. 3·9; 243 lb/ft^3; $5{\cdot}65 \times 10^{22}$ atoms hydrogen/c.c.; lead equivalent, 28·7 per cent; 2·9 mm lead/cm.

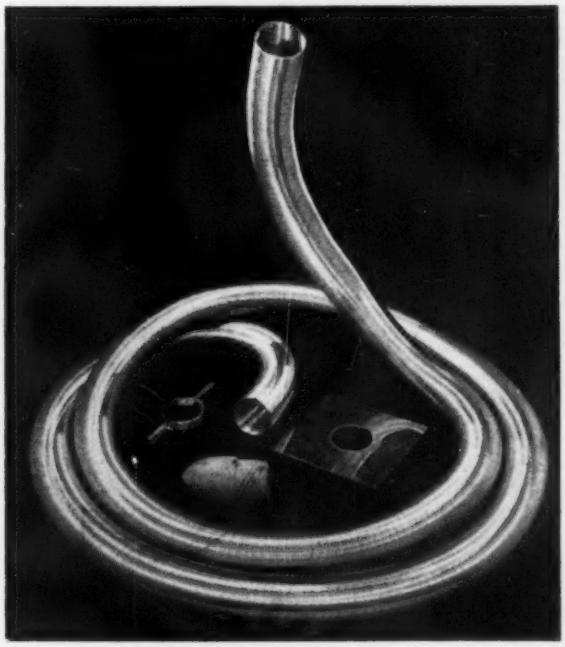
This material, a product of Associated Lead Manufacturers Ltd., known as "Densithene", can be readily jointed by heat, using normal methods used for polythene, and filler rods are available for welding. It can also be cemented and fixed to metal surfaces using lead filled epoxy resin cements

Pliable Lead Linings Protect Stackwork

A LEAD-LINED pliable flue lining tube, which will resist attack from the most corrosive condensation which can be expected from the flue gases of gas-fired heating appliances, and so protect chimney stack brickwork from costly damage, is the latest development of "Kopex" pliable tubing. The Gas Council have approved the new lead-lined tube as a material suitable for application as a flue lining for use with gas appliances. Its manufacturers, Uni-Tubes Ltd., are now producing this new lead-lined tube in addition to the aluminium alloy pliable flue lining tube which has proved to be useful in preventing condensation damage from oil-fired appliances.

Coils of up to 100 ft. in length are being produced with 3 in., 3½ in., 4 in., 5 in., 6 in. and 7½ in. inside diameters. Bending radius = 2½ × diameter of tube (taken at centre line of tube).

Right: Pliable lead-lined "Kopex" flue lining tube for gas appliances



Below: Some machined components produced from the lead-polythene mixture "Densithene"

OUT OF THE MELTING POT

Shock Refining

VARIOUS instances arise in which the usual grain refinement procedures cannot be used or are found to be undesirable. Welded parts, particularly large and complicated structures, for example, are not amenable to the application of plastic working and heat-treatment to bring about the very desirable grain refinement of the weld metal and of the heat-affected portions of the parent metal. Another example is provided by certain high-temperature alloys which cannot be worked and have to be cast to the required shape, the resulting castings possibly containing regions of coarse grain size which obviously cannot be refined by the deformation-heat-treatment technique. Even where plastic working can be used to manufacture wrought products, the grain refinement achieved may not be uniform throughout a product of unsymmetrical shape. In all such cases, where conventional procedures are unable to help, grain refinement can be achieved by the novel technique which involves exposing the metal to be grain-refined to the shock wave generated by the detonation of a high explosive, and then heating the metal to the recrystallization temperature. The details of this technique depend on the configuration of the parts to be treated and on other factors. Essentially it consists in placing a layer of explosive, either directly on the surface of the metal or on an intermediate shock wave-moderating and transmitting material. The arrangement may be such that a detonation front parallel to the surface of the metal is set up, or converging fronts may develop, as when the explosive layer is wrapped round the metal object. The layer of explosive may be surrounded by a confining medium, e.g. lead. Exposure to the shock wave, while it introduces a large amount of energy into the metal, causes no significant dimensional changes. The higher the shock wave loading, the lower the temperature and the shorter the time required for the subsequent recrystallization. In the case of allotropic metals, the temperatures required are considerably lower than those at which allotropic phase transformation occurs.

Filled Filler

NOWADAYS, interest in materials filled (usually reinforced) with another material in the form of fibres, whiskers, lamellae, powder, etc.) is very much in evidence, and examples are encountered more and more frequently, sometimes in the most unlikely places. An example is provided by what may perhaps be referred to as a filled brazing filler metal. This material comprises a skeletal lamellar structure, the interlamellar spaces of which are filled with the brazing alloy proper. For brazing compositions to be used for brazing ferrous alloys, the skeletal metal may be iron, cobalt or nickel. The brazing alloy may, for example, be a silver-copper composition. The skeleton is prepared by sintering the powder of the required metal, without any previous compaction, to produce a body having a porosity of about 50 per cent. This sintered body is then infiltrated with the molten brazing alloy and, after cooling, the composite metal body is rolled or drawn to form sheet, strip or wire in which the particles of the skeletal metal are flattened or elongated. The skeletal metal filler thus forms a collapsible lamellar metallic structure which holds the brazing alloy in its interlamellar spaces. When such a brazing composition is heated to a temperature above the melting point of the brazing alloy while under pressure, the skeletal metal collapses and the brazing alloy is expressed at the pressure application points, while at points where no pressure is applied, the brazing alloy will tend to remain absorbed in the skeletal metal and stay in place. Run-off of the brazing alloy is thus minimized.

Transferred Deposit

FOR various reasons, metal deposits formed by electrochemical displacement, such as that which occurs, for example, when iron or zinc is immersed in a copper sulphate solution, have little practical utility as coatings. Interest in such electroless coating methods has been further reduced by the success of electroless nickel plating which depends on catalyzed chemical reduction, and is of value where conventional electroplating may be impracticable. Of the surviving electrochemical displacement methods of electroless plating, only the zincate process for preparing aluminium for electroplating comes at all readily to mind. It is therefore intriguing to meet a recent claim not only to an electrochemical displacement process of forming a copper coating, but one in which the electrochemical mechanism, in some unexplained way, would appear to be used as an intermediate or external agency, the copper being deposited on a surface other than that of the metal effecting the electrochemical replacement. The process, which specifically is intended for use in depositing a copper backing on a silver glass mirror, involves the mixing of a stream of acidified copper sulphate solution with a stream of a homogeneous suspension of the precipitating metal (zinc or iron) in powder form. The resulting homogeneous mixture is then at once sprayed towards the surface to be copper plated (i.e. the exposed silver surface of the mirror) in such a manner that droplets of the mixture arrive at the surface before there has been sufficient interaction within the mixture to precipitate appreciable amounts of metallic copper. A solution containing 2 to 10 per cent copper sulphate is used and is acidified with sulphuric acid to produce a *p*H in the mixture to be sprayed of between 0·5 and 3. The zinc powder should have a particle size of not more than 20 micron. The use of iron powder with a particle size of 5 to 7 micron is preferred. To keep the metal powder in uniform dispersion before the mixing and spraying, carboxymethyl cellulose and formaldehyde are added to the suspension.

Skimmer

Electric Heating For Non-Ferrous Metals

By J. T. Sharples, B.Sc. Tech., A.M.I.E.E.

(*Concluded from* METAL INDUSTRY, 3 *November* 1961)

ELECTRONIC devices such as the simple thermionic valve have long demonstrated the heating effect of an electron beam bombardment, but only in the past decade has this heating effect been deliberately applied to a wide range of problems, initially in the laboratory but now undergoing extensive development in the commercial field.

As its name implies, electron beam, or electron bombardment, heating requires the production of a controlled beam of electrons between an emitter, in the form of a heated filament, and the charge. This is only practicable in atmospheric pressures below about 0·001 mm. Hg. In its simplest form a heated filament emits an accelerated beam of electrons towards the charge, which is held at a positive potential relative to the filament, and which is heated by the kinetic energy of the electrons. This arrangement can be used for heating relatively large areas.

A refinement of this arrangement interposes a modulator at about the same potential as the filament, between the latter and the charge to control the beam, and in a more highly developed arrangement of this the electron beam is accelerated towards an anode, passing through a hole in this and then through focusing and deflection coils before bombarding the charge. In this way, the beam can be accurately adjusted with regard to both the area of heating (from say 1 mm^2 to 100 mm^2 or more) and the position of this heated area on the charge or relative to the original direction of the beam. The heated area need not be circular. In this way, too, very high power densities are possible, values of 500,000 kW/cm^2 having been reported.

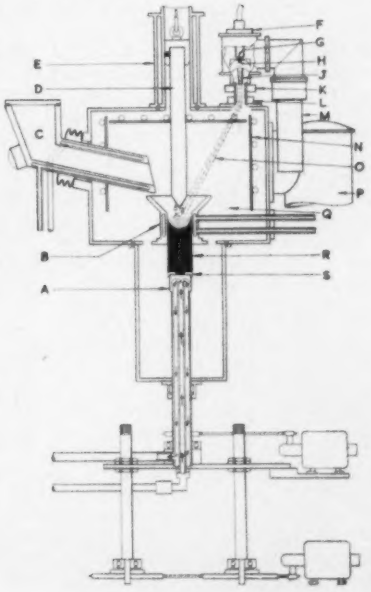
It will be apparent that the accurate control of power, area and position make this method of heating readily applicable to zone refining and single crystal pulling techniques, and it has been widely used in these applications in the laboratory, more particularly for crystal pulling. Of more general interest to the non-ferrous industry, however, is its application to the vacuum melting of high purity and high melting point metals, competitively with the vacuum melting methods already discussed.

Unless the Battelle cold mould induction method is developed commercially, electron beam melting shows the same advantage over vacuum induction melting as the consumable electrode process, namely, lack of crucible contamination. Compared with the consumable electrode arc process, electron beam melting can avoid the electrode formation process and can produce vacuum melted ingots directly from swarf or scrap material. Moreover, since in the consumable electrode process the arc length has to be kept relatively short, some impediment to the release of volatiles from the molten surface is imposed by the near presence of the electrode in the ingot mould. In the electron beam furnace, the electron beam can be focused and deflected on to the charge, contained in a water-cooled copper hearth or mould, from an electron "gun" positioned some distance away. The width, depth and temperature of the molten pool can be more accurately controlled, irrespective of the rate of addition of the charge, and there is improved control of solidification.

It is, however, necessary to avoid pressure build-ups caused by volatilization of impurities, etc., which could lead to electrical discharge breakdowns, and this implies the use of really adequate vacuum pumping capacity and/or current surge limiting devices. A third measure is to isolate the electron guns in a separate evacuated chamber and allow the beam to enter the melting chamber through an aperture large enough for this purpose but small enough to maintain a suitable pressure difference. This method is being followed by A.E.I. Ltd. in this country in the development of a 100 kW furnace of the multi-gun type which will be capable of melting 4½ in. molybdenum ingots in a water-cooled retractable ingot mould. Variable focus and deflection means will, however, allow a variety of moulds to be used as well as a range of charges (Fig. 20).

Electron beam melting has been more extensively developed in the U.S.A. Already reported in METAL INDUSTRY, 29 August 1958, p, 176, is the 300 kW furnace at Stauffer Metals Division of Stauffer Chemical Co., New York, for refining and casting ingots of refractory metals up to 8 in. dia. by 42 in. long and capable of outputs up to 30,000 lb/month. The Temescal Metallurgical Corporation of California is building this year a furnace weighing about 25 tons which will turn out ingots of 20 in. dia. by 6 ft. long of titanium and zirconium alloys, superalloys and special steels, niobium alloys of 16 in. dia. and molybdenum and tantalum alloys of 12 in. dia. This furnace will be able to turn out more than 100,000 lb. of nickel-base alloys per month, and will provide a maximum control of composition.

Another major application of electron beam heating lies in the welding field, vacuum welding being particularly appropriate for such metals as tantalum, niobium and molybdenum



A—Water-cooled rotating hearth. B—Water-cooled hopper type mould in various sizes. C—Water-cooled flexibly mounted vibratory feed for swarf, pellets and alloying. D—Rod or ingot to be melted. E—Water-cooled jacket. F—One of 3 electron guns. G—Filament. H—Cathode. J—Anode aperture. K—Focus coils. L—Deflection coils. M—4 in. vacuum pump. N—Condensation plates. O—Path of electron beam. P—20 in. vacuum pumps serving main chamber. Q—Main vacuum chamber. R—Purified ingot. S—Hearth adaptor for alternative ingot diameters to match varying mould sizes.

Fig. 20—Typical design of A.E.I. ingot-melting electron beam furnace

which can suffer from pick-up in inert-gas welding. It is stated to have enabled butt welds of molybdenum sheet to be bendable cold for the first time, freedom from pick-up being aided by release of volatile molybdenum oxide to the vacuum. The welding process is made particularly attractive by the degree of control which can be given to the power, focusing and positioning of the beam, which allows not only high power on a small spot for deep penetration but also larger-area low power preheating or after-heating as desired. The potential trouble from pressure build-ups by release of metallic vapours is minimized by pulsing the heat input so that metal atoms are evacuated during the off cycle. Improved mechanical properties are imparted to welds in beryllium, zirconium and similar metals and the method is used on a commercial scale in France and U.S.A. for welding of fuel elements for atomic energy reactors.

New Developments

Two developments have recently been reported which, if brought to maturity, could encroach on the field that is being marked out for vacuum heating processes. These are indicative of the way in which development can be so rapid as to make any forecast of future trends a hazardous operation.

The first is concerned with processes involving heating and cooling under pressure and for rapid cooling when called for, and, as an example, is being suggested for brazing of difficult materials such as the Nimonic family. Wild-Barfield and G.W.B. Furnaces have acquired certain patent rights to build furnaces which will use controlled atmospheres at above atmospheric pressure, quite the reverse of the vacuum process already mentioned. Experimental work was first directed towards getting rid of the retort hitherto found necessary in furnace brazing these alloys (as distinct from vacuum brazing) and eventually resulted in the evolution of an insulating brick, capable of 1,600°C., which was practically non-reactive to hydrogen at high temperatures, had minimum retention of water vapour and no sulphur inclusion. Furnaces so bricked gave good brazing results without enclosure of the charge in a retort, with obvious advantages, and attention was then directed to improving heat transfer and providing quicker but controlled heating and cooling. To this end, the heating elements, for example, of molybdenum rod are supported away from the refractory lining to reduce heat loss, and hydrogen has been used at pressures up to 30 lb/in^2 gauge further to increase the rate of heat transfer to the charge. By circulating the hydrogen through a water-cooled heat exchanger a rapid, uniform and controlled rate of cooling can also be obtained. It is suggested that further development along these lines and with other gases could materially improve some of the existing techniques now being followed in heat-treatment processes.

The other development is reported by the Mond Nickel Company as a possible and less expensive alternative to vacuum processes for the removal of volatile impurities in molten metals. This, in effect, is similar to the non-consumable electrode furnace except that the vacuum is replaced by an inert gas which flows downwards in an annular space surrounding the electrode and then upwards and eventually out of the furnace through an annular space surrounding the first. The combination of electric arc and inert gas produces an intensely hot ionized mixture or plasma and this gives extremely high local temperatures where it impinges on the metal charge contained in a shallow refractory vessel. The gas stream protects from oxidation the molten metal in the heating zone and by its pressure precludes from this zone the slag which forms on the metal surface outside its influence. On its outward journey, the gas carries away the volatile impurities released by the high local heating, the metal being stirred electromagnetically to bring fresh metal continuously into this central zone.

Conclusion

As this necessarily brief review of electric heating methods shows, electricity has many more weapons in its armoury than any of the fuels, all of which must rely solely on heat transfer to the charge surface from a heat source external to it. Some of the newer methods discussed are still in the relatively early stages of development and while developed and practically obligatory for the newer and high purity metals, are gradually finding their feet in the commercial world. By all these means, electricity can clearly cover practically all known heating processes, in many cases providing alternative methods which can be critically examined in order to achieve the best combination of all those factors involved in the economical attainment of high quality and high productivity; matters of considerable importance to the economic outlook of the individual firm as well as that of the country as a whole.

Torsion Testing Small Specimens

ESPECIALLY suitable for instruction purposes in colleges and universities, as well as for the production testing of wire and other specimens in industry, the Tinius Olsen "Lo-Torq" torsion testing machine will handle specimens up to a maximum of 1 in. dia. by 18 in. long.

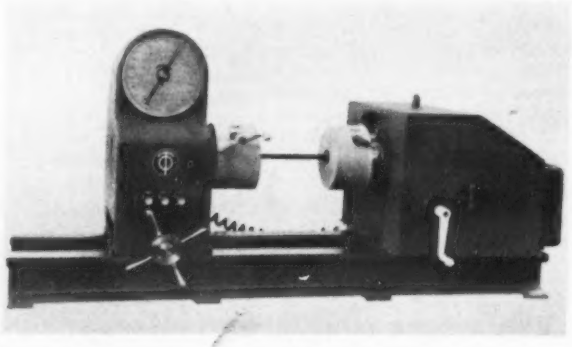
The three-jaw holding chucks are graduated in degrees for determining the angle of twist and testing is carried out in one direction of rotation.

The load is weighed by torque bars and is mechanically indicated on a 10 in. dia. dial, and on the standard machine two ranges of reading to full or to one-tenth capacity are easily selected. Normally the machine is built with a maximum torsion capacity of any one of 10,000, 5,000 or 2,000 in.-lb.

The machine is arranged for manual operation in addition to having a single speed motor drive. Hand operation is used when accurate torsional yield strengths and torsion stress-strain curves are desired; and the motor drive, which can be engaged at any time and gives a rotational speed of 180°/min., is used for testing to destruction or for production testing. Alternatively, to the single-speed motor an electronic variable speed motor drive giving a speed range from 5° to 180°/min. can be supplied.

A special "ElecTOmatic" Lo-Torq machine, having a 28 in. diameter dial and four range capacities up to the maximum of 10,000 in.-lb., is also available. This machine is fitted as standard for motor-drive only with a variable speed range of from 5° to 180°/min.

Edward G. Herbert Limited, of Atlas Works, Levenshulme, Manchester, represent the Tinius Olsen Testing Machine Company in Great Britain and Ireland.



The Tinius Olsen "Lo-Torq" torsion testing machine for specimens up to 1 in. diameter and 18 in. long

Industrial News

Home and Overseas

Press Brake Guards

We are advised that all the personnel on the engineering side involved with the design and manufacture of **Rubery Owen** press brake guards have now been transferred to Boucher and Company Ltd., of Kidderminster. Manufacture, erection and servicing of the press brake guard will now be carried out by the latter company.

Sintered Metal Components

One of the Plessey group of companies, **Machine Products Limited,** is exhibiting a comprehensive range of die-pressed sintered metal components at the Engineering, Material and Design Exhibition being held at Earls Court this month.

The piece-parts and sub-assemblies on show are representative of those in current production for leading manufacturers, and are of iron, steel and bronze in several grades of density. They include fuel pump, switchgear, tabulating machine and domestic equipment applications, and are shown in various finishes.

Half-Yearly Meeting

Members of the **National Association of Non-Ferrous Scrap Metal Merchants** are reminded that the half-yearly meeting of the association will be held at the Midland Hotel, Birmingham, on Tuesday, December 5 next. The luncheon for members has been arranged to be held at the hotel on the same date at 12-45 p.m.

Forging Press Order

News from **D. L. Lombard and Sons Engineering Ltd.** is that they have recently shipped to India one of their British built self-contained 500-ton Lombard forging presses. The press will be installed at the works of India Pistons Ltd., in what is considered to be one of the world's most up-to-date plants for the manufacture of pistons, piston rings, cylinder liners, gudgeon pins, etc.

This press is very simply operated by means of an hydraulic servo-motor control lever which provides rapid acceleration and quick reversal of delivery. This small lever requires only a very light operating force and the ram will retract or lower at a speed depending upon the amount of its displacement from the neutral horizontal position.

The maximum return and advance speeds are 740 in/min., and the pressing speed, which commences automatically when ram contacts workpiece, is 76 in/min. The oil-hydraulic circuit incorporates an "Oilgear" infinitely variable delivery radial piston type pump, giving a particularly smooth action in a compact simple unit. It is driven by a 150 h.p. motor.

Windows and Curtain Walling Contract

Now completed is the contract for windows and curtain walling for the Empress State Building, at Fulham, by **Williams and Williams Ltd.** The wall cladding was erected remarkably quickly owing to the ingenious system used. One floor was completed every week, and each floor contains 63 panel units.

Having been prefabricated in the company's works, the panels arrived on the site complete with double-hung windows. They were then hung on hook sections fastened to the floor slabs of the building. The panels were joined together by means of a system of spigots. Vitreous enamel steel infilling panels were placed between the bands of windows. These are of trough section and are coloured blue.

Another interesting feature of this building is the structural columns, which are completely clad in extruded aluminium covers, also supplied by Williams and Williams.

Industrial Safety Awards

Despite the overall rise in industrial accidents during last year, 22 firms in Great Britain have gained the British Safety Council's "Industrial Safety Award" as compared with 16 in 1959. The award, one of the most coveted in industrial safety, is based on the firm's accident frequency rate, and only firms with exceptionally high safety standards have a chance to qualify. Every accident where a worker has lost time is taken into consideration.

Among the award-winning firms for 1960 were **Charles Clifford Ltd.,** of Birmingham, **Concentric (Non-Ferrous) Ltd.,** also of Birmingham, and **A. Elliott (Electro-platers) Ltd.,** of Newcastle upon Tyne.

Replacement Parts

A new system to ensure the maintenance of adequate supplies of replacement parts throughout the country has recently been adopted by Renault Ltd. To facilitate ease and speed of delivery, they have a fleet of articulated lorries, the bodies of which are constructed of aluminium-faced plywood, making it difficult to dent the sides of the vehicle and presenting a surface notably free of "weaving".

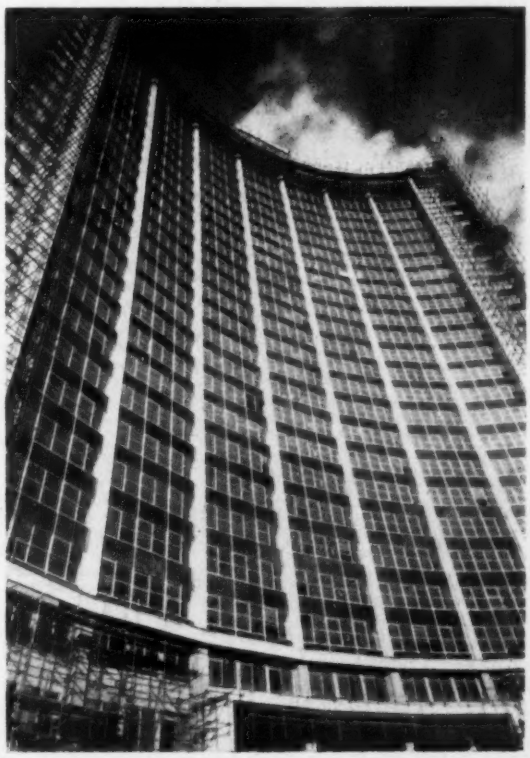
The major innovation of the scheme lies in the method of packing the replacement parts. These are packed and transported in lightweight collapsible aluminium containers manufactured by Light Alloy Construction Ltd. **The British Aluminium Company Ltd.** supplied the sheet used in the fabrication of these containers.

Made from a strong HS30W aluminium alloy sheet 1·5 mm. thick, with hardened steel corners, these containers are said to be able to withstand years of rough handling and, when locked, defy the efforts of the most determined pilferer.

Scientific Instruments on Show

Many instruments for gas analysis and temperature measurement are being displayed on the stand of the **Cambridge Instrument Company Limited** at the Northern Exhibition of Fuel and Power, which opens on Saturday of next week at Queen's Hall, Leeds, and remains open until Monday, November 27.

Among the gas analysis instruments is a complete Cambridge outfit for measuring and recording the oxygen and carbon-dioxide content of flue gases. Other



Structural columns, clad in extruded aluminium covers, used in the Empress State Building, Fulham, by Williams and Williams Ltd.

boilerhouse instruments include a variety of draught and pressure gauges, humidity instruments, mechanical and electrical thermometers, a disappearing filament pyrometer, and the recently redesigned portable CO_2 and temperature indicator.

An Australian Works

An interesting brochure has reached us from the Australian firm of Metal Manufactures Limited, which describes in some detail the company's works at Port Kembla, New South Wales. An introduction deals with a brief history of the organization, and then various sections of the brochure gives facts relating to the foundry, the tube factory, the wire factory, the covered wire factory, the case and drum factory, and details of their aluminium products.

The brochure is profusely illustrated, many illustrations being in colour, and helps to present to the reader a very satisfactory idea of the extent of the activities of this progressive organization.

Furnaces for Poland

An order for furnaces to the value of £153,000 has been received by **AEI-Birlec Limited** from Centrozap, of Poland. The contract calls for the supply of two continuous twin-track, gas-fired gas carburizing furnaces, each to give an output of 300 kg/hr., together with washing machines, tempering furnaces, the conveyor tracks between these units, and certain other items.

Also called for in the order are special atmosphere generators for the carburizing furnaces, with automatic temperature and dewpoint control. These furnaces will be used chiefly for the heat-treatment of gears and other components required in the manufacture of tractors.

Aluminium in Sports Stadium

One of the newest and most unusual sports stadiums in the United States is that opened recently in Washington. In its construction, aluminium was utilized to reduce weight in a large section of portable stands. It is said to be the first "convertible" stadium in the U.S.A. Constructed for the Washington, D.C., Armory Board, the $24,000,000 stadium is designed for quick conversion from the normal football horseshoe to the traditional baseball diamond right angle for maximum visibility and utilization. The design provides a rotating aluminium and steel section which forms the U of a horseshoe for football. For other events, the aluminium U-sections collapse and a movable side line stand slides out on rails to form a right-angle with a stationary stand. The convertible section of the stadium was fabricated by Reeves Steel Inc., of Tampa, Fla., using Kaiser Aluminum plate supplied by Fullerton Metals Company. The plate, alloy 5005 H-14 in. ·220 gauge, forms decking which rests on collapsible steel frames. The entire unit is designed for easy handling and rapid erection and dismantling.

Forthcoming Meetings

November 13 — Institute of Metals. Scottish Local Section. Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow. "The Effects of Irradiation on Materials." Dr. H. M. Finniston. 6.30 p.m.

November 13—Institution of Production Engineers. Sheffield Section. Grand Hotel, Sheffield. "Human Relations in Industry." E. Fletcher. 6.30 p.m.

November 14—Institute of Metal Finishing. South-West Branch. Royal Hotel, Cardiff. "Basic Principles of Electroplating." R. A. Wilding. 7.30 p.m.

November 14 — Institution of Works Managers. Birmingham Branch. College of Technology, Gosta Green, Birmingham. "Delegation and its Control." L. H. Sutton. 7 p.m.

November 14—West of England Metallurgical Society. College of Science and Technology, Ashley Down, Bristol. "Teaching Metallurgy to Metallurgists and Engineers." Prof. J. G. Ball and L. W. Derry. 7 p.m.

November 15 — Institution of Plant Engineers. Kent Branch. Railway Hotel, Dartford. "Hydraulic Control Systems." J. C. Wells. 7 p.m.

November 15—Institution of Production Engineers. Peterborough Section. Conference Room, F. Perkins Limited, Peterscourt, Peterborough. "Surface Finish." R. E. Reason. 7.30 p.m.

Powder Metallurgy

It is learned that the winter meeting of the **Powder Metallurgy Joint Group** of the Iron and Steel Institute and the Institute of Metals will be held at Church House, Great Smith Street, London, S.W.1, on Thursday and Friday, December 7 and 8 next.

The afternoon session on the first day will commence at 2·30 p.m. under the chairmanship of Dr. G. L. Miller, and in the evening an informal dinner has been arranged for members of the group at Ayrton Hall, Imperial Institute Road, London, S.W.7.

On the following day, the morning session will commence at 10 a.m. and will be presided over by Dr. L. B. Pfeil, while the afternoon session, commencing at 2.30 p.m., will again be under the chairmanship of Dr. Miller.

Tinplate Review

A special review number on the tinplate industry has been published by *Metal Bulletin*, and is devoted entirely to a world-wide survey of the industry and includes many relevant statistics, illustrations, and a world tinplate producers' directory. The review covers over 60 pages and may be obtained at the price of 7s. 6d. per copy, post free.

Australian Mineral Exports

Statistics published in Canberra show that Australian mineral exports in 1960 were valued at A£90,000,000, or 10 per cent of the total value of exports. This equals the previous peak of A£90,000,000 in 1956 and 1957. The Minister for National Development, Senator William Spooner, said that exports of primary mineral commodities in 1960 were valued at A£62,600,000. Senator Spooner was reading from the latest issue of the *Australian Mineral Quarterly Review*. He said that the value of uranium oxide exports was A£11,000,000 and newly-won gold A£16,300,000.

Lead exports earned A£20,300,000, copper A£13,500,000, zinc A£8,400,000, coal A£6,500,000, rutile A£4,100,000, pig iron and ingot steel A£2,600,000, silver A£1,100,000.

Safety Training Courses

A series of safety training courses for foremen and supervisors, started recently by the **British Safety Council,** is to be held in most major towns throughout the country during the next twelve months. These courses have already proved popular in industry and in most cases are being held in conjunction with the Institute of Industrial Supervisors.

The first courses are being held in Bristol (November 14/15), Liverpool (November 21/22), and London (November 28/29). Full details of all these up to May next year may be obtained from the offices of the Council at 60 Westbourne Grove, London, W.2.

A New Factory

Because of the constantly growing demand from home and overseas for Aerograph-deVilbiss spray painting and finishing equipment, new and larger factory and administration premises have been built at West Howe, Bournemouth, for the **Aerograph-DeVilbiss Company Limited.**

Production of spray guns, air compressors, automatic spray coating machines, portable spray painting plants, paint heating units, airless spraying equipment and a wide range of water-wash and dry-back spray booths has been transferred from the company's premises at Lower Sydenham.

In addition to the manufacturing plant, the company's head office, sales division and export department has been transferred to the new premises, together with an enlarged spray painting instruction school and a demonstration and customer research centre. The existing sales division office in London will continue to handle all business in London and the Home Counties, while the provincial offices will also continue to stock a large range of standard equipment and spare parts. The head office of the Lysaght-DeVilbiss sales organization, which handles complete product finishing systems from pretreatment to final bake, will also be transferred to West Howe.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 214 tons to 4,219 tons, comprising London 1,258, Liverpool 1,567 and Hull 1,394.

Copper stocks fell 225 tons to 15,335 tons, distributed as follows: London 450, Liverpool 13,235, Birmingham 50, Manchester 1,525, Hull 50 and Glasgow 25 tons.

Lead duty-free stocks fell 725 tons to 6,932 tons, comprising London 6,457, Glasgow 225, Swansea 100, and Manchester 150 tons. In-bond stocks fell 34 tons to 3,493 tons, all in London.

Zinc duty-free stocks fell 65 tons to 7,559 tons, comprising London 2,553, Glasgow 51, Hull 325, Manchester 300, Liverpool 55, and Avonmouth 4,275 tons. In-bond stocks fell 128 tons to 3,035 tons, all in London.

The Need to Work

If Britain wanted prosperity, management and men had got to work for it, because the world in general and the European Common Market in particular did not offer an easy living, Mr. T. Crompton, finance director of Yorkshire Imperial Metals, said in Birmingham on Monday night. Unless this country increased its exports over the next two years by at least 10 per cent each year there would be another balance of payments crisis, he told members of **Birmingham Junior Chamber of Commerce** at their annual banquet.

"These are the facts and this is the problem facing British industry," he said. "We will be priced out of much export business unless we get down to it and improve our efficiency by reducing administrative costs.

"Even if we are merely to stay where we are, we have got to reduce costs to eliminate the inflationary factor. Another factor of great importance in the export market is to establish a reputation for reliability. Our delivery times should be sacrosanct, but too often they are not," said Mr. Crompton.

On the European Common Market, Mr. Crompton said that there were divided opinions in the political parties about entering it, and fiercely opposing views inside company board rooms. It was naive to assume that because the formation of the Common Market was accompanied by tremendous economic growth in Western Europe that this country would necessarily share in the same prosperity. He was sure, however, that the change was just another form of opportunity if there was the right mental attitude towards it.

Mr. Crompton responded to the toast of "The Future of British Industry and Commerce", proposed by the President of the Junior Chamber, Mr. S. J. Wooldridge. Among those present at this function were the Lord Mayor of Birmingham, Alderman Eric E. Mole, O.B.E., J.P., Dr. J. J. Gracie, C.B.E., LL.D., President of the Birmingham Chamber of Commerce and Director, The Mint (Birmingham) Ltd., Mr. W. P. G. McGeoch, President of the National Brassfoundry Association, and Mr. H. J. Sells, managing director, Metal Sales Company Ltd.

New Contract

It is reported that Brown Bayley Steels Limited have placed a contract worth some £800,000 with **The Brightside Foundry and Engineering Company Ltd.** for a 32 in. blooming mill and reconstruction of the existing 28 in. finishing mill at their Attercliffe works. The plant will provide increased output and size range of the company's high quality alloy and stainless steels.

West German Production

According to statistics from Frankfurt, West Germany's production of pig aluminium during September amounted to 14,573 tons (provisional) against 15,118 tons in August. Pure aluminium production in September totalled 1,355 tons (provisional) against 1,513 tons in August, while aluminium alloy production was 10,203 tons (provisional) against 9,098 tons in August.

Foundries produced 20,058 tons (provisional) of refined copper in September against 19,787 tons in August, and refineries 6,057 tons (provisional) against 5,294 tons in August. Copper alloy production amounted to 3,359 (provisional) compared with 3,200 tons in August. Semi-manufactureds produced from aluminium and aluminium alloys totalled 18,723 tons (provisional), against 19,851 tons previously, and from copper and alloys 52,061 tons (provisional) against 52,116 tons in August.

Indonesian Tin Development

British firms might co-operate with the Indonesian Government in opening new tin workings under the sea, Lieut.-Col. Rudy Pirngardie, the President-Director of Indonesian State Mining Enterprises, said at a press conference in Djakarta this week. Col. Pirngardie represented Indonesia at the recent London meeting of the International Tin Council, and has toured Europe and the United States seeking opportunities for expanding Indonesian tin trade. He said Indonesia was negotiating for long-term credits to modernize mines on the Java Sea Islands of Bangka, Billiton and Singkep.

British businessmen had shown interest in Indonesian plans to develop undersea workings, and a number of British experts in this field would arrive here shortly. In West Germany he had seen preparations for the building of smelting machinery recently ordered by Indonesia.

Southern Rhodesian Production

Figures issued by the Department of Mines in Salisbury show that Southern Rhodesia produced 8·02 tons of tin concentrates in September this year, against 5·11 tons in August, and 4·34 tons in September last year. Production for the January-September period of this year totalled 54·51 tons, compared with 41·76 tons in the corresponding period of 1960. Production of tin metal in September this year totalled 71·09 tons, against 63·06 tons in August, and 52·08 tons in September last year. Production for the first three-quarters of this year amounted to 570 tons, against 512·11 tons in the corresponding period of last year.

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for August 1961 have been issued by the Aluminium Industry Council as follows (in long tons) —

Virgin Aluminium	
Production	2,523
Imports	19,070
Despatches to consumers	19,274
Secondary Aluminium	
Production	7,562
Virgin content of above	710
Despatches (including virgin content)	7,835
Scrap	
Arisings	10,586
Estimated quantity of metal recoverable	7,907
Consumption by	
(a) Secondary smelters	8,453
(b) Other uses	903
Despatches of wrought and cast products	
Sheet, strip and circles	10,908
Extrusions (excluding forging bar, wire-drawing rod and tube shell)	
(a) Bars and sections	2,749
(b) Tubes (i) extruded	198
(ii) cold drawn	392
(iii) formed strip	—
(c) (i) Wire	1,200
(ii) Hot rolled rod (not included in (c) (i)	107
Forgings	298
Castings (a) Sand	1,339
(b) Gravity die	3,452
(c) Pressure die	1,639
Foil	1,903
Paste	235

Southern Rhodesia produced 2,292 tons of copper in September this year, against 2,013 tons in August and 1,575 tons in September last year, the Department of Mines stated. Production for the first nine months of this year totalled 11,918 tons, compared with 11,223 tons in the corresponding period of last year.

Sales Appointment

For physical and chemical experiments where visible or ultra-violet radiation plays a part, strong monochromatic sources are an important aid. For most experiments it is necessary that the different sources be interchangeable both as regards electrical and geometrical characteristics.

To meet these demands, Philips Electrical Ltd. have introduced a new range of spectral lamps with transformers, and **Griffin and George (Sales) Ltd.** have been appointed distributors for these and have also developed a new stand and control gear to be used in conjunction with them.

The lamps are of the spectrum discharge type for experiments in the fields of biology, chemistry, interferometry, polarimetry, refractometry and spectroscopy. The transformers are auto-leak of the low-power factor type. The stands have a heavy base with an 18 in. polished upright carrying a lamp bracket, adjustable for height, with an E.S. lampholder. A special feature of this stand is that it is universal in use, the one stand accommodating any one lamp of three different types.

A Luncheon Meeting

Speaking about her experiences some years ago in the metal trade, and of more recent experiences in Soviet Russia, Miss Olga Franklin was the guest speaker at a luncheon held by the **Non-Ferrous Club** in Birmingham on Tuesday last. Describing the changes in Russian life since the death of Stalin, she laid great stress on the paucity of consumer goods available to the Russian public. She attributed distribution difficulties to some extent to the absence of middle men. She also spoke of the part Russian women play in Soviet life and mentioned the high number of divorces, and emphasized that life in Russia for many ordinary people was extremely boring and lacked avenues for relaxation and amusement.

At this luncheon a collection was taken on behalf of the Earl Haig "Poppy Day" Fund, the sum of £38 10s. 4d. being collected.

Research Developments

Continued growth in specialized fields has called for an expansion of the Research and Development Organization of **Tube Investments Limited.** The central organization will consist of a newly-formed Engineering Development Design office, concerned with advancing the specialized engineering of process plant, the Metallurgical Research Laboratory at Hinxton Hall, concerned with physical metallurgy and metal physics, and a Department of Technical Information in Birmingham.

Organizations for the three main metal processing divisions are: a new Iron and Steel Research and Development Department, with headquarters at Rotherham; a new organization for the steel Tube Division, which will be developed from the T.I. Technological Centre at Walsall; and the British Aluminium Laboratory, at

Gerrards Cross, Bucks., which will continue to follow research and development on the manufacture and use of aluminium and aluminium alloys.

Development work in the Engineering, Electrical and Cycle Divisions will be carried out mainly by the companies concerned, with the co-operation, when needed, of the Metallurgical Laboratory at Hinxton Hall, and the Engineering Development Design Office.

Indian Bauxite Exports

It is reported from New Delhi that the Government of India has decided to allow the export of 350,000 tons of bauxite annually for the next two years. Of this quantity, 150,000 tons of bauxite will be allowed for export from the port of Saurashtra and 100,000 tons each from Bombay and Calcutta. Exports will be allowed irrespective of the origin of the bauxite.

The Government has been reviewing the export policy of bauxite for some time past in view of the rapid development of the aluminium industry in India on a massive scale. Having regard to the export commitments already made by Indian exporters, the present policy has been decided as a short-term policy for the next two years. Exporters are being advised not to enter into any commitments beyond this period of two years.

New Mineral Dressing Laboratory

Extensions to the facilities of the Department of Metallurgy at the **Sir John Cass College,** London, have recently been made by the provision of a mineral dressing laboratory. The equipment, much of which was supplied by the Fraser and Chalmers works of **G.E.C. (Engineering) Ltd.,** has been chosen to demonstrate to second-year metallurgy students the basic principles of various mineral dressing techniques. However, the apparatus is just as well suited to mineral dressing test work.

The G.E.C. equipment installed in the laboratory includes an Armstrong classifier, grinding equipment, a Sherwen electromagnetic feeder complete with hopper, a Sherwen test-sieve shaker, a Wilfley No. 13A concentrating table with interchangeable decks Riffled for sands and slimes, a Denver jig and a Denver froth flotation cell.

The grinding equipment, which is similar to that developed for use in G.E.C.'s own mineral dressing laboratory at Erith, can be set up to simulate almost all commercial ball-mill and rod-mill arrangements, and can give results which are typical of full size plants.

News from Birmingham

At the monthly meeting of the Midland Regional Board for Industry, the reduced demand in the metal-consuming industries was mentioned by the chairman, Major C. R. Dibben. General engineering, he said, continued to be busy, particularly in machine tools, chemicals and building and civil engineering. But in the consumer goods field, demand remains slack for the more expensive articles like cars, motor cycles and domestic appliances. Firms supplying components to the motor industry are being affected increasingly by reduced demand. He also suggested that the Board considered it essential for the Government to be ready to take appproppriate action as soon as practicable to lift restrictions on credit, not least because their prolongation tends increasingly to prohibit confidence at home, and to hamper efforts to raise the rate of growth of production. Easement should not be delayed until activity has been so reduced as to produce an appreciable degree of unemployment and short-time working.

No improvement has taken place in the iron and steel industry. The brightest department is that of structural steel due to the unusual amount of rebuilding which is taking place throughout the country. Ironfoundries could take on a lot more work if orders were forthcoming. There is a moderate demand for heavy castings and forgings for the engineering trades.

Canadian Copper Discovery

According to recent news from Toronto, Canadian Dyno Mines reported the discovery of an important copper-bearing structure 70 miles east of James Bay and 260 miles north of the Mattagami Lake mines, in northwest Quebec.

The reported copper discovery was on claims held by the Duncan Range Iron Mines. Canadian Dyno said it has options which, if exercised, would result in its owning over 75 per cent of the issued capital of Duncan Range. Canadian Dyno said that on its own behalf it has also acquired various claims adjoining the discovery. Mr. W. N. Ingaham, consulting geologist, according to the company, reported that samples of the copper-bearing structure assayed 4·3 to 23·8 per cent copper and 0·36 to 5·22 oz. silver.

Price Reductions

Continued expansion in the production of 'Araldite' has enabled **CIBA (A.R.L.) Ltd.** to announce further reductions in the prices of their epoxy resins. Reduction has been made in most products of the 'Araldite' range, and full details are available from the company.

Company Reports

Amalgamated Tin Mines, Nigeria

Net profit, year to March 31, 1961, £430,671 (£242,885) and dividend 25 (20) per cent. Fixed assets £545,000 (£572,000), buffer stock £350,146 (same), current assets £2,991,753 (£2,620,786) and liabilities £433,184 (£367,128).

British Aluminium Co. Ltd.

Group trading profit year to July 31, 1961, £4,741,949 (£5,133,651), net profit £1,249,804 (£2,118,312) and dividend 10 per cent (12). Total assets £65,021,862 (£48,685,355) all companies other than Canadian British Aluminium Company. Fixed assets £17,265,406 (£13,977,658). Development expenditure bauxite deposit in Australia £84,660 (nil). Investment in Canadian British Aluminium £6,928,675 (£6,305,271). Associated companies and other investments £7,783,347 (£7,920,917). Current assets £28,469,474 (£20,481,509). Goodwill arising out of acquisition of aluminium undertaking of Reynolds T.I. Aluminium £4,490,300 (nil), Current liabilities £12,462,930 (£10,557,957). Authorized expenditure £15,587,000 (£2,003,000) and outstanding £1,302,510 (£511,423).

Cope Allman and Co.

It is reported that this company is acquiring the equity capital of Troman Bros. for £85,000 to be satisfied by the issue of 60,000 5s. "A" Ordinary shares. In the opinion of the directors the net assets applicable to the equity at September 30, 1961, was £60,000. It is estimated that the profits for the current year will be approximately £25,000, subject only to tax.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

H. Marshall King Limited (703957), 55 North Street, Thame, Oxon. Registered September 22, 1961. To carry on the business of suppliers of and dealers and workers in steel and other metals, etc. Nominal capital, £1,000 in £1 shares. Directors: Hedley M. King and Mrs. L. F. King.

Mineral Enterprises Limited (704023), 187 Wollaton Street, Nottingham. Registered September 25, 1961. To acquire any mines, mining rights and metalliferous land and any interest therein and to explore, work, develop the same, etc. Nominal capital, £100 in £1 shares. Directors: Jean M. Brammer and Keith S. Astill.

New Zealand Aluminium Company Limited (704027), 9 Basinghall Street, E.C.2. Registered September 25, 1961. Commonwealth Aluminium (U.K.) Ltd. shall be sole director and manager. Subscribers: Commonwealth Aluminium (U.K.) Ltd. and Broken Hill Secretariat Ltd.

Chard Street Metals Limited (704073), 47 Bath Square, Chard, Somerset. Registered September 25, 1961. Nominal capital, £3,600 in £1 shares. Directors: James C. Hillman, Albert Case, Kersey R. Cooke and Ernest W. Oliver.

A. King and Sons Limited (704271). Registered September 27, 1961. To take over the business of iron, steel and non-ferrous metal merchants, iron and steel stockholders and mobile crane hirers carried on as "A. King and Sons", carried on at Ber Street, Norwich, and elsewhere, etc. Nominal capital, £100 in £1 shares. Directors to be appointed by subscribers.

Beryllium and Copper Alloys (Moulds and Dies) Limited (704704), 47 Victoria Street, S.W.1. Registered October 3, 1961. Nominal capital, £1,000 in £1 shares. Directors: Bernard R. Symonds, George H. Symonds, Hugh T. L. Symonds, Douglas Symonds and Wm. H. St. George.

Connard Metals Limited (704763), 38 Great Portland Street, W.1. Registered October 3, 1961. Nominal capital, £1,000 in £1 shares. Directors: Bernard Conway and Mrs. M. Conway.

Metal Market News

UNDER the influence of the reduction in the Bank Rate to 6 per cent and the better tone on Wall Street, the Metal Exchange presented a more cheerful appearance last week. The Stock Exchange also picked up to some extent, so that all the way round things looked better. In Whittington Avenue tin was the leader, and the price went ahead satisfactorily in the face of better demand by the consumers both here and on the Continent. Falling stocks have now forced the establishment of a backwardation, which stood at £6 on Thursday afternoon. There was a turnover of 2,200 tons in tin, and a fall of 122 tons in the reserves in official warehouses which, at the beginning of last week, stood at 4,433 tons. At the close of business on Friday, the cash price was £19 up at £974, while three months had scored an advance of £13 at £969. There is now, once again, a good deal of optimism about the outlook for the price of tin over the rest of this year, but in the background of any forward appraisal of the tin situation is the uncertainty of what is going to happen to the American stockpile metal in the new year. True, there has been a reassuring statement by the President, which certainly suggests that the quotation is unlikely to be under pressure due to ill-advised action in releasing tonnage in an uncontrolled fashion. Nevertheless, there is bound to be a measure of apprehension, and it is probably premature to foresee a price of £1,000 for tin before the end of the year, although in certain quarters this is being talked about.

The volume of dealing on the market is still quite impressive, and last week saw some very good support with a demand for cash, which contracted the contango and finally wiped it out in favour of a backwardation. For the week, the highest price was seen on Thursday, when cash stood at £980 and three months at £975, so that the close was appreciably below the best.

The first price alteration in non-ferrous metals for a long time in the United States was seen last week, when the lead quotation was brought down by ½ cent to 10½ cents/lb. Stocks of lead in official warehouses were increased by 575 tons to 11,184 tons. On the market, the turnover amounted to 9,100 tons, prices being rather easier on balance, for cash lost 5s. to £61 15s. 0d. and three months 10s. to £62 10s. 0d. Although stocks of lead in L.M.E. warehouses are increasing, demand is said to be very well maintained, and it has been reported that metal has been shipped to the Continent. Some 4,600 tons of zinc changed hands on the market, cash losing 5s. and three months 2s. 6d. to close at £71 and £71 17s. 6d. for the respective positions. L.M.E. stocks went up by 385 tons to 10,787 tons.

There was again a decline in the stocks of copper in Metal Exchange warehouses, the fall amounting to 592 tons, bringing the total down to 15,558 tons. Business with consumers was again reported to be slow, but perhaps rather better than the previous week. It was during the second half of the week that the copper market firmed up on news of possible strike trouble in Chile, but the rally did not go very far and dealing was not very brisk. At the close, cash was £230 and three months £230 5s. 0d., these prices being up respectively 15s. and 5s. The contango was reduced from 15s. to 5s. and there are fears that a backwardation may return. The turnover was about 11,500 tons. Two custom smelters reduced their buying price for scrap by ¼ cent.

New York

Copper futures were steady at the week-end in moderate trading. In physical copper, dealers noted a steadier undertone to their domestic and export copper, but dealings were very quiet. November copper from custom smelters or producers was about sold out. Scrap copper was quiet and steady. Tin was softer but quiet. Spot offered at 123¾, November at 123½, December at 123 and January at 122¾ cents/lb. Lead was quiet. Zinc, mostly prime western, was fair. In the closing stage, tin was quiet and steady. The other metals remained unchanged.

India

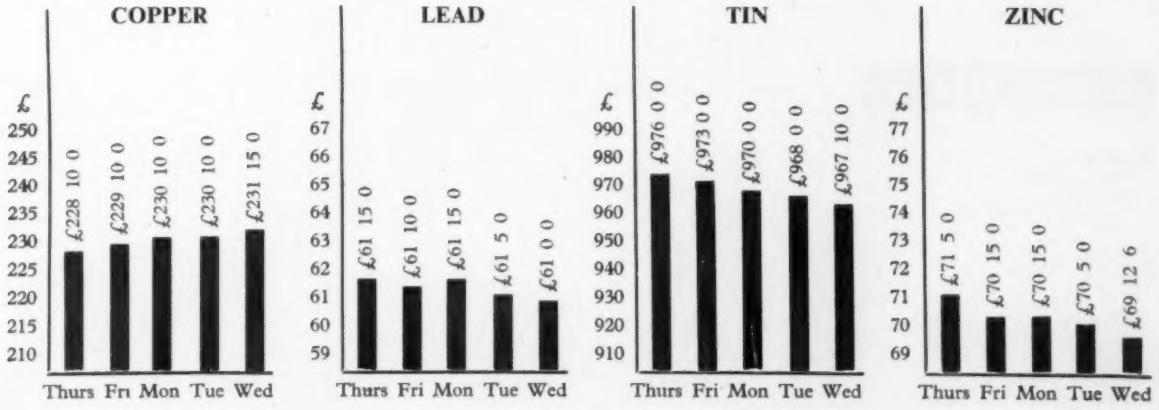
Speaking at a Press conference in New Delhi, Mr. Shriman Narayan, a member of the Planning Commission, said that in view of the shortage of copper in India, the Commission has given high priority to the Khetri and Kho Dhariba copper projects in order to save foreign exchange. The work on both the projects had been entrusted to the national mineral development corporation, he added. The detailed project report was expected to be ready by March.

The Khetri project would consist of a mine with concentrating plant and a smelter, with an annual capacity of 10,000 tons of copper. The estimated cost of the project was Rs. 100,000,000. On the basis of the data obtained from investigation, the mine was estimated to contain about 28,000,000 tons of copper ore, and as such the prospects were very good, he said.

Mr. Narayan said that in the Kho Dhariba deposits in Alwar district, an area of about two square miles had already been explored. The ore in the Dhariba had been found to be richer than that of Khetri.

London Metal Exchange

Thursday 2 November to Wednesday 8 November 1961



C

NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 8/11/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide				
Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	6
Calcium	„	2	0	0
Cerium 99%	„	18	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite	per unit		8	10
Copper H.C. Electro	ton	231	15	0
Fire Refined 99·70%	„	230	0	0
Fire Refined 99·50%	„	229	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	10	1¾
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	61	0	0
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot, AZ91X		1	1½-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	60	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	8
Tellurium Sticks	lb.	2	0	0
Tin	ton	967	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	70	3	0
Dust 95/97%	„	115	5	0
Dust 98/99%	„	121	5	0
Granulated 99+%	„	95	3	9
Granulated 99·99+%	„	106	11	3

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 8/11/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	nom.		
B.S. 1490 L.M.6 „	„		
B.S. 1490 L.M.7 „	„		
B.S. 1490 L.M.8 „	„		
B.S. 1490 L.M.9 „	„		
B.S. 1490 L.M.10 „	„		
B.S. 1490 L.M.11 „	„		
B.S. 1490 L.M.12 „	„		
B.S. 1490 L.M.13 „	„		
B.S. 1490 L.M.14 „	„		
B.S. 1490 L.M.15 „	„		
B.S. 1490 L.M.16 „	„		
B.S. 1490 L.M.18 „	„		
B.S. 1490 L.M.22 „	„		
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	144	0	0
B.S. 1490 L.M.2 „	145	0	0
B.S. 1490 L.M.4 „	154	0	0
B.S. 1490 L.M.6 „	170	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	238	0	0
BSS 1400 AB.2 „	245	0	0

		£	s.	d.
***Brass**				
BSS 1400-B3 SCB2	ton	177	0	0
BSS 249	„	173	0	0
***Gunmetal**				
B.S. 1400: LG2 d/d	„	210	0	0
B.S. 1400: LG3 d/d	„	221	0	0
B.S. 1400: GI 1½ Pb d/d	„	279	0	0
B.S. 1400: GI ½ Pb d/d	„	294	0	0
***Manganese Bronze**				
BSS 1400 HTB1	„	191	0	0
BSS 1400 HTB2	„	212	0	0
BSS 1400 HTB3	„	228	0	0
Nickel Silver				
Casting Quality 12%	„	255	0	0
„ „ 16%	„	265	0	0
„ „ 18%	„	310	0	0
***Phosphor Bronze**				
B.S.1400P.B.1.(A.I.D. released)	„	314	0	0
B.S. 1400 L.P.B.1	„	235	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	251	0	0
15% „	254	0	0
Phosphor Tin			
5% „	1049	0	0
Silicon Bronze			
BSS 1400-SB1 „	260	0	0
Solder, soft, BSS 219			
Grade C Tinmans „	432	0	0
Grade D Plumbers „	341	5	0
Grade M „	477	6	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „		—	
Zinc Alloys			
BSS 1004 Alloy A ton	100	1	3
BSS 1004 Alloy B „	104	1	3
Sodium-Zinc lb.		2	6

SCRAP METALS

Merchants' average buying prices delivered, per ton, 7/11/61

Aluminium	£
New Cuttings	134
Old Rolled	100
Segregated Turnings	72
Brass	
Cuttings	154
Rod Ends	141
Heavy Yellow	132
Light	127
Rolled	142
Collected Scrap	129
Turnings	133

Copper	£
Wire	205
Firebox, cut up	203
Heavy	197
Light	192
Cuttings	208
Turnings	194
Braziery	162
Gunmetal	£
Gear Wheels	196
Admiralty	196
Commercial	175
Turnings	170

Lead	£
Scrap	53
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	175
Turnings	170
Zinc	
Remelted	64
Cuttings	53
Old Zinc	34

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

		£	s.	d.
Aluminium				
Sheet 10 S.W.G.	lb.		2	10½
Sheet 18 S.W.G.	,,		3	0½
Sheet 24 S.W.G.	,,		3	3½
Strip 10 S.W.G.	,,		2	10½
Strip 18 S.W.G.	,,		2	11½
Strip 24 S.W.G.	,,		3	1
Circles 22 S.W.G.	,,		3	4½
Circles 18 S.W.G.	,,		3	3½
Circles 12 S.W.G.	,,		3	2½
Plate as rolled	,,		2	10
Sections	,,		3	4
Wire 10 S.W.G.	,,		3	1½
Tubes 1 in. o.d. 16 S.W.G.	,,		4	4
Aluminium Alloys				
BS 1470. HS19W.				
Sheet 10 S.W.G.	,,		3	3
Sheet 18 S.W.G.	,,		3	5½
Sheet 24 S.W.G.	,,		4	1
Strip 10 S.W.G.	,,		3	3
Strip 18 S.W.G.	,,		3	4½
Strip 24 S.W.G.	,,		4	0½
BS1477. HP30M. Plate as rolled	,,		3	1
BS1470. HC15WP.				
Sheet 10 S.W.G.	,,		4	3
Sheet 18 S.W.G.	,,		4	8½
Sheet 24 S.W.G.	,,		5	8½
Strip 10 S.W.G.	,,		4	4
Strip 18 S.W.G.	,,		4	8½
Strip 24 S.W.G.	,,		5	4½

		£	s.	d.
Aluminium Alloys—cont.				
BS1477. HPC15WP. Plate heat treated	lb.		3	10½
BS1475. HG19W. Wire 10 S.W.G.	,,		4	2
BS1471. HT19WP. Tubes 1 in. o.d. 16 S.W.G.	,,		5	5
BS1476. HE19WP. Sections	,,		3	4
Split tube				
19 S.W.G. (⅛″)	,,		4	2
20 S.W.G. (⅛″)	,,		3	11
21 S.W.G. (⅛″)	,,		4	1
22 S.W.G. (¼″)	,,		4	11
Welded tube 14 to 20 S.W.G. (sizes ½″ to 1½″)	,,	3/5½ to 5/5		
Brass				
Tubes	lb.		1	9¾
Brazed Tubes	,,		3	1¾
Drawn Strip Sections	,,		3	1¾
Sheet	ton	195	10	0
Strip	,,	195	10	0
Extruded Bar	lb.		2	0
Condenser Plate (Yellow Metal)	ton	184	0	0
Condenser Plate (Naval Brass)	,,	198	0	0
Wire	lb.		2	8½

		£	s.	d.
Beryllium Copper				
Strip	lb.		1	4 11
Rod	,,		1	1 6
Wire	,,		1	4 9
Copper				
Tubes	lb.		2	3⅛
Sheet	ton	266	0	0
Strip	,,	266	0	0
H.C. Wire	,,	282	5	0
Cupro Nickel				
Tubes 70/30	lb.		3	8¾
Lead				
Pipes (London)	ton	103	5	0
Sheet (London)	,,	101	0	0
Tellurium Lead	,,	£6 extra		
Nickel Silver				
Sheet and Strip 10%	lb.		3	11¾
Wire 10%	,,		4	4⅛
Phosphor Bronze				
Wire	,,		4	2⅛
Titanium (1,000 lb. lots)				
Billet 4½″ to 18″ dia.	lb.	47/-		48/-
Rod ¼″ to 4″ dia.	,,	85/-		53/-
Wire ·036″·232″ dia.	,,	159/-		99/-
Strip ·001″ to ·048″	,,	350/-		68/-
Sheet 8′×2′. 20 gauge	,,	73/-		
Tube, representative average gauge	,,	198/-		
Extrusions	,,	90/-		
Zinc				
Sheet	ton	108	5	0
Strip	,,	nom.		

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	132.55	968 16

Canada	c/lb	£/ton
Aluminium	24.00	194 8
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.25	1,200 17
Copper: electrolytic	3.20	236 9
Lead	.93	68 14
Nickel	9.00	665 2
Tin	13.59	1,004 6
Zinc: Thermic	1.07	79 1
Zinc: electrolytic	1.15	85 0
Scrap		
Copper: electrolytic	2.82	208 7
Heavy copper	2.82	208 7
No. 1 copper wire	2.75	203 4
Brass rod ends	2.15	158 17
Zinc castings	.85	62 16
Lead	.85	62 16
Aluminium	1.80	133 0

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	475	277 8
Copper: wire bars 99·9	440	256 19
Lead	162	94 12
Nickel	1,300	805 14
Tin	1,820	1,062 17
Zinc: electrolytic	172	100 8
Scrap		
Aluminium soft sheet clippings (new)	295	172 5
Lead, soft, first quality	135	78 16
Lead, battery plates	75	43 16
Copper, first grade	365	213 3
Bronze, commercial gunmetal	420	245 7
Brass: heavy	270	157 13
Brass: light	255	148 18
Brass, bar turnings	265	154 15
Old zinc	98	57 4

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.88	242 4
Lead	.80	67 5
Nickel	7.68	645 17
Tin	11.68	982 5
Zinc: High grade 99.99	.98	82 8

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	280,000
Copper wire No. 1	250,000
Copper wire No. 2	240,000
Heavy copper	234,000
Light copper	226,000
Brass, new cuttings	190,000
Red brass scrap	218,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	220	200 8
Heavy copper	216	196 15
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	90	82 0

United States	c/lb	£/ton
Aluminium	24.00	1591
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	121.75	970 6
Zinc: electrolytic	12.50	99 12

THE STOCK EXCHANGE

Markets Undecided

ISSUED CAPITAL ●	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 6 NOVEMBER +RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	29/– +6d.	11	9	7 11 9	33/9	26/3	35/–	26/6
400,000	2/–	Anti-Attrition Metal	1/3	NIL	4	NIL	1/3⅜	0/9	1/6	0/9
43,133,663	Stk. (£1)	Associated Electrical Industries ...	30/9 +1/3	15	15	9 15 0	54/10½	28/3	67/3	38/3
3,895,963	1	Birfield	62/–	10	15‡	3 4 6	78/9	45/–	51/3	29/–
4,795,000	1	Birmid Industries	68/6	20	20	5 16 9	103/–	68/3	74/9	56/–
8,445,516	Stk. (10/–)	Birmingham Small Arms	21/9 +2/–	17½QT	12½	5 8 0	36/10½	19/3	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	12/6	5	5	8 0 0	14/6	12/3	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	15/6	6	6	7 14 9	17/6	15/4½	20/–	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	16/3	6	6	7 7 9	18/–	15/3	21/1½	17/7½
21,737,634	Stk. (£1)	British Insulated Callender's Cables	57/3 +2/–	13½	13½	4 16 0	62/3	49/–	61/4½	47/–
30,683,348	5/–	British Oxygen Co. Ltd., Ord. ...	16/– —9d.	16D	16	3 6 9	28/4½	14/9	35/–	19/10½
1,200 000	Stk (5/–)	Canning (W.) & Co.	14/6 +6d.	15⅜	25+*2½C‡	5 13 0	20/9	13/7½	19/9	13/7½
60,484	1/–	Carr (Chas.)	1/–	NIL	12½	—	1/7½	10½d.	2/3	1/–
550 000	1	Clifford (Chas.) Ltd.	29/–	12	10	8 5 6	31/–	26/–	35/–	28/9
45,000	1	Ditto Cum. Pref. 6%	15/–	6	6	8 0 0	15/3	15/–	16/–	15/10½
1,166,000	Stk. (2/–)	Clifford Components V	8/– +3d.	25*2½C	25*2½C	6 5 0	10/1½	7/3	11/9	6/10½
300,000	2/–	Coley Metals	2/7½ —1½d.	15	15	11 8 6	4/5½	2/7½	5/–	3/4½
10,185,696	1	Cons. Zinc Corp.†	60/– +9d.	20	15	6 6 9	81/6	58/6	80/9	59/6
5,399,056	5/–	Davy-Ashmore	30/–	27½	22½	4 11 3	44/6	29/6	147/3	99/6
8,995,011	5/–	Delta Metal	20/6 +6d.	20	17½	4 17 6	27/7½	19/–	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	38/–	15	15	7 18 0	52/3	36/6	56/9	45/–
1,155,000	1	Evered & Co.	42/9	10	10ϕB	4 13 6	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	26/3 +1/–	10	10	7 12 6	39/6	24/3	47/9	29/–
1,500,000	Stk. (10/–)	General Refractories Ltd.	48/9	25	20	5 2 6	65/–	42/9	52/6	40/–
937,500	5/–	Glacier Metal Co. Ltd.	16/9 +6d.	15	13	4 9 6	21/1½	13/9	16/1½	11/1½
2,750,000	5/–	Glynwed Tubes	22/6 —6d.	22½	25¶	5 0 0	30/3	22/6	27/6	17/–
7,228,065	10/–	Goodlass Wall & Lead Industries ...	30/9 +2/3	15	19L	4 17 6	44/9	28/–	41/9	33/–
696,780	10/–	Greenwood & Batley	14/6	15	30‡	10 7 0	29/6	14/3	33/6	29/1½
792 000	5/–	Harrison (B'ham) Ord.	8/9	*10	*20‡	5 4 3	14/6	8/6	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	18/3 +3d.	7	7	7 13 6	20/4½	18/–	23/6	22/–
1,612,750	5/–	Heenan Group	13/4½ +4½d.	13	15	4 18 0	17/1½	10/6	13/–	9/10½
266,608,683	Stk. (£1)	Imperial Chemical Industries ...	61/9 +1/6	13¾	11½	4 8 6	81/6	56/3	76/6	54/–
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/–	5	5	6 13 3	16/–	13/10½	18/–	15/4½
29,196,118	**	International Nickel	142 +2½	$1.60	$1.50	1 18 0	160	104	105	84½
6,000,000	1	Johnson, Matthey & Co.	74/– +4/–	15	12	4 1 0	75/3	57/6	67/6	44/9
600,000	10/–	Keith, Blackman	17/6	17½	17½E	10 0 0	21/6	16/6	32/6	17/6
320,000	4/–	London Aluminium	11/3	13	12	4 16 3	15/–	8/6	12/6	7/10½
2,667,542	1	McKechnie Bros. A Ord.	34/– +2/–	11½K	17½	7 17 3	53/3	32/–	69/3	55/–
1,108,268	5/–	Manganese Bronze & Brass	9/9xd	20½	20½	11 0 0	18/6	9/3	18/6	13/4½
50,628	6/–	Ditto (7½% N.C. Pref.)	5/– —3d.	7½	7½	9 0 0	6/–	5/–	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	80/6 +5/–	12	12M	2 19 9	100/9	68/3	84/3	61/–
415,760	Stk. (2/–)	Metal Traders	7/6	50	50	13 6 9	8/9	6/9	10/9	7/1½
240,000	1	Mint (The) Birmingham	34/3 +6d.	15G	12½	5 16 9	35/9	24/–	39/–	33/6
80,000	5	Ditto Pref. 6%	71/–	6	6	8 9 0	77/6	70/–	80/–	75/–
274,152	1/–	Minworth Metals	4/9 —3d.	30	30S	6 6 3	6/3	4/6½	5/2½	3/10½
5,187,938	Stk. (£1)	Morgan Crucible A	58/9 +1/3	14	13	4 15 3	71/3	53/4½	63/–	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	15/6	5½	5½	7 2 0	17/–	13/10½	18/9	15/9
3,850,000	Stk. (£1)	Murex	39/– +1/–	13	22½J	6 13 3	52/–	36/9	45/–	35/3
585,000	5/–	Ratcliffs (Great Bridge) Ord. ...	15/6xd	10	10R	3 4 6	16/6	15/6	17/–	14/9
1,064,880	10/–	Sanderson Kayser	34/– +1/–	17½	35‡	5 3 0	41/3	29/–	40/3	27/7½
3,400,500	Stk. (5/–)	Serck	13/1½xd —7½d.	12½	12½	4 15 3	19/3	13/1½	25/6	15/3
212,384	5/–	Stedall & Co.	7/6	15	15	10 0 0	10/3	7/3	10/3	6/3
8,035,372	Stk. (£1)	Stone-Platt Industries	41/6xd —1/6	16	15	7 14 3	67/–	39/6	64/4½	52/3
2,928 963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/6	5½	5½	7 2 0	18/–	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	63/9 +3/3	14	18½	4 7 6	85/6	54/–	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	26/6 +6d.	10	10	7 11 0	38/3	25/9	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/–	5	5	7 13 9	15/–	12/4½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	20/– +6d.	*5	*5	7 8 9A	21/1½	18/–	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord	66/–xd —9d.	13⅜	13⅜	4 4 3	84/6	64/6	94/–	63/–
7,109,424	Stk. (£1)	Westinghouse Brake	26/– +1/3	11	10	8 9 0	46/3	24/6	60/6	37/6
323,773	2/–	Wolverhampton Die-Casting ...	7/9	35	30	9 0 9	13/4½	7/9	13/10½	8/1½
591,000	5/–	Wolverhampton Metal	20/–	32½	32½	8 2 6	30/–	20/–	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/3	15	20‡	8 16 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	12/9	6	6	9 8 3	13/7½	12/6½	15/–	13/6
150.000	1/–	Zinc Alloy Rust Proof	4/4½ +1½d.	40	30	9 2 9	5/6	4/–	5/4½	4/–

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. ● The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units. ϕ and 6¼% from Capital Profits. B and 50% capitalized issue. G and 50% capitalized issue. F and special 5% tax free dividend and 50% capitalized issue. ¶and 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. Q also 1/– special tax free dividend and 50% capitalized issue. T Per £1 unit. K 50% capitalized issue allowed for. S and 50% capitalized issue. V incorporating Clifford Covering.

The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables.

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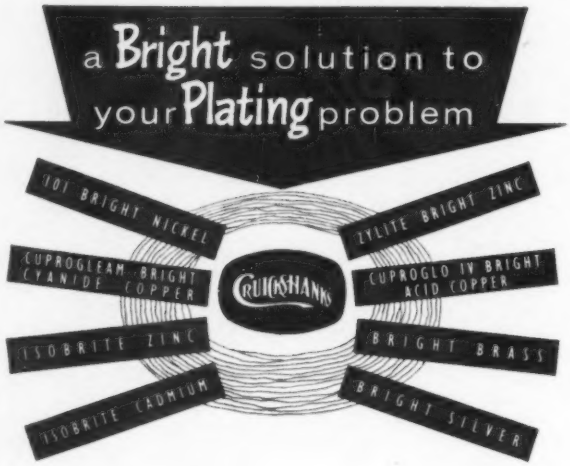

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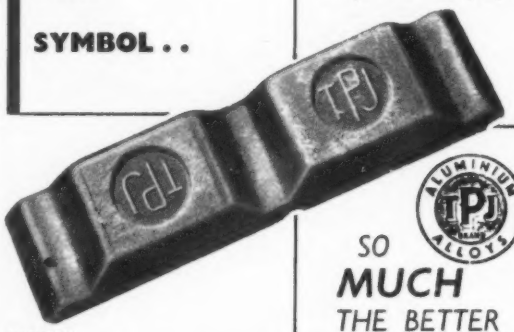

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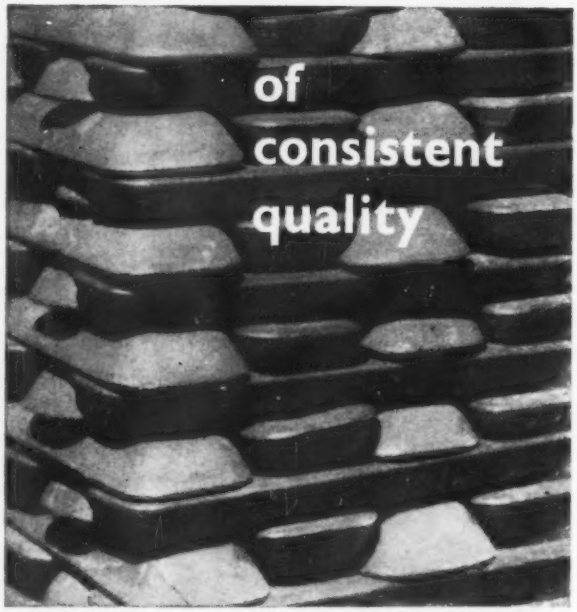

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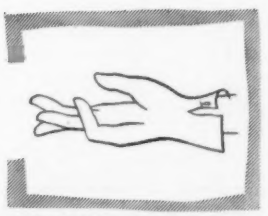

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